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John A. White
Chancellor



Fayetteville, Arkansas 72701

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A Message from the Chancellor:

Throughout the University of Arkansas community we are celebrating the successful completion of the historic \$1 billion Campaign for the Twenty-First Century. The Campaign has made such a difference for our campus. Its impact will be felt for generations to come. From scholarships and fellowships to new buildings to endowed professorships, the results of this Campaign will enhance every aspect of our University. I'm particularly pleased about the positive impact achieving this milestone will continue to have on the University of Arkansas' research programs.

The resources the Campaign has secured have attracted top rank researchers to Fayetteville. Their discoveries, innovations and insights will help lead the state of Arkansas, our nation and world to a brighter tomorrow, through the knowledge and spirit of innovation they impart to our students. Few research universities offer the kind of hands-on research experience to students—both graduates and undergraduates—that the University of Arkansas offers. The Campaign for the Twenty-First Century is helping ensure that our students have access not only to award-winning faculty members, but also to some of the finest research facilities available anywhere.

The Campaign has provided the U of A with undeniable momentum. This past December, an independent think-tank at the University of Florida called TheCenter included the University of Arkansas among the top tier of the nation's research universities in their report, The Top American Research Universities. Our University ranked with the likes of MIT, Johns Hopkins and Harvard, and ahead of several prestigious institutions. Much of our success in this ranking was directly attributable to the Campaign for the Twenty-First Century.

As you read this issue of Research Frontiers I hope you share my excitement over the cutting-edge work conducted at the University every day. And I invite you to envision even greater things to come. Hard as it is to believe, this is just the beginning. The Campaign for the Twenty-First Century has provided the margin for excellence that will continue to lead the University of Arkansas and its research programs to the forefront of the nation's leading institutions of higher education.

Happy reading,

John A. White

John A. White
Chancellor

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The Metropolitan Museum of Art, The Cloisters Collection, 1966 (56.70). Photograph © 1990 The Metropolitan Museum of Art.

Opening Doors

Forget park-sized art installations and cartoon cells – in the 15th and 16th century, triptychs were all the rage, according to art professor Lynn Jacobs. The best artists painted them, religious orders used them in churches, and business people bought them for the home. Often, religious triptychs were commissioned as memorials to be placed at the gravesites of donors wanting to transcend from the secular to the sacred realm.

Jacobs is writing a book about these “paintings with doors,” as they were referred to in the Netherlands and elsewhere at that time. In the 15th and 16th centuries, artists such as Jan van Eyck, Hieronymus Bosch and Robert Campin created triptychs, many of which remain well known today, like Bosch's Garden of Earthly Delights. And even as they went out of fashion, Peter Paul Rubens created the Antwerp triptychs of the early 17th century.

Often but not exclusively religious in nature, these paintings consisted of three painted wooden panels with hinges that allowed them to be opened and closed. Triptychs often sported paintings that gave the illusion of sculpture on the exterior of the panels.

Jacobs became interested in the intersection between format and

meaning while writing her first book: “Early Netherlandish Carved Altarpieces: Medieval Tastes and Mass Marketing,” published by Cambridge University Press. As she pursued her current research into triptychs, she discovered that the artists used this format to create symbolic doors – boundaries between different levels of reality, different times and spaces, different levels of status and different worlds.

“In some triptychs, there seems to be a deliberate ambiguity,” she said. These triptychs seem to depict “a space that is connected and disconnected at the same time.”

For instance, in “The Annunciation” triptych by Robert Campin, shown above, Jacobs points to the painting of a door, which on the left side panel

reveals the donor and his wife and on the middle panel depicts Mary and an angel. Once when Jacobs was at the Cloisters in New York, she stood in front of the painting, contemplating the door. Is it a opening or a barrier? Can the monk see what is happening in the middle panel? As she gazed and wondered aloud, a crowd began to gather with her, surrounding the painting.

“Everyone had a different opinion,” she said. “It made it clear that these paintings can be really hard to interpret.” ■



Photo by Russell Cochran

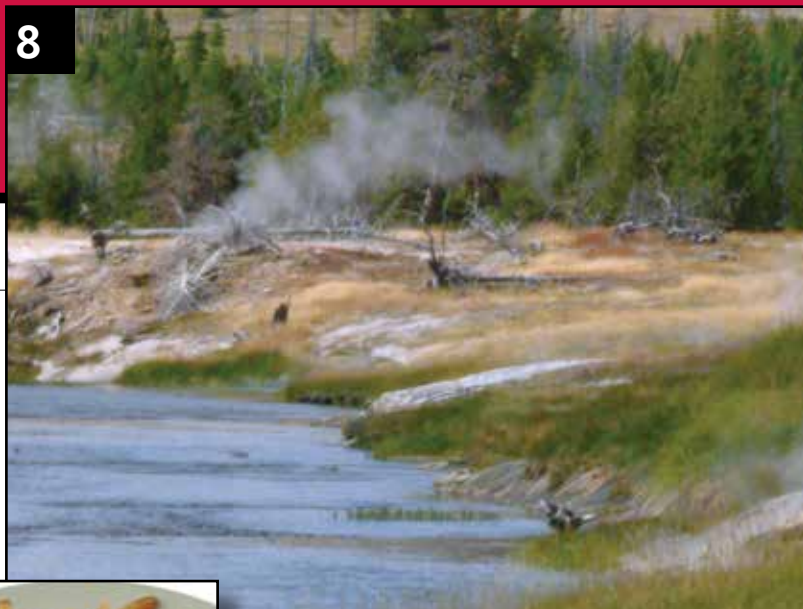
Lynn Jacobs

Without food preservation research and technologies, we'd still be plucking our own.



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HOTSPOT

In Yellowstone National Park, the earth seems to breathe beneath the tourists' feet. Geoscientists examining lakeshore processes at Yellowstone Lake believe that the lakeshore may be exhibiting this swelling and shrinking, and they have spent the last two summers investigating this possibility.

INFORMED INGESTION

When people order fast food, they often get more than they bargained for in terms of calories and fat, say two marketing professors. Their research has demonstrated that nutrition information, when provided on the spot, can influence consumers' decisions when it comes to ordering food from the menu.

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TASTE TEST

Panels of trained taste testers and a host of untrained consumer panelists try food in the name of bringing better products to the kitchen table. Food scientists try to tease out the elements of taste – including texture – that make people say “yum” or “yuck.”

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GRANDMOTHER LOVE

A School of Social Work researcher studies the challenges African-American grandmothers face when they raise their own children's children – often facing obstacles from the state and federal government.

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Leslie Yingling studies how and why students voted in the 2004 election and looks at the issues that moved them the most.

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Art professor Lynn Jacobs examines the symbolism of triptychs, “paintings with doors,” that enjoyed popularity in the 15th and 16th centuries.

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Cover: The moon rises over Yellowstone Lake, where geosciences professor Stephen K. Boss and his students have spent two summers studying the lakeshore process of this lake within a living volcano. Stephen Boss, photo.



Build Muscles, Feel Alluring

A study by doctoral student Tina Penhollow found that college students who exercise frequently and see themselves as physically fit are more likely to rate themselves higher with regard to sexual performance and sexual desirability than those who exercise less and don't rate themselves as fit.

"This study supports the notion that exercise may go beyond its traditional role as protective factor and enhance individuals' sexual self-esteem," Penhollow said.

Penhollow's study deals with how exercise affects sexual self-esteem and self-perception – a topic that

hasn't been researched in the same depth as the actual benefits of exercise. It was published in the *Electronic Journal of Human Sexuality*.

"Much of the research that has been done has focused on sexual satisfaction, and desired frequency of sexual behavior due to improvements in physiological functioning as a result of exercise," Penhollow said. "There's plenty of research out there on the health benefits of fitness, but not much research into how exercise can improve perceptions of oneself sexually."

Penhollow surveyed 408 undergraduate students. Four questions focused specifically on exercise frequency, perceived fitness, self perceptions of sexual desirability and sexual performance. For the exercise frequency data, participants chose from four answers ranging from exercising less than one day per week to exercising six or seven days per week. For perceived fitness, sexual desirability and sexual performance, subjects were asked to rate their levels using a range from much below average to much above average.

College students were chosen for the study because their age group has been shown to be most likely to be sexually active. ■



photo by Russell Cotten

Researchers Using Arkansas' First Supercomputer

Researchers have already produced results using Red Diamond, the state's first supercomputer, and they have plans for more – developing the molecular structures of potential new drugs, examining tornados and volcanoes, and modeling global climate change. The machine boasts a cluster of 128 dual-processor computers and operates approximately 256 times faster than the typical new desktop computer.

"Red Diamond will help solve some of the most challenging science and engineering problems in the world today," said Amy Apon, associate professor of computer science and engineering and the leader of the effort to bring the supercomputer to the university. "UA researchers have already used Red Diamond to calculate the molecular structure of new nanomaterials."

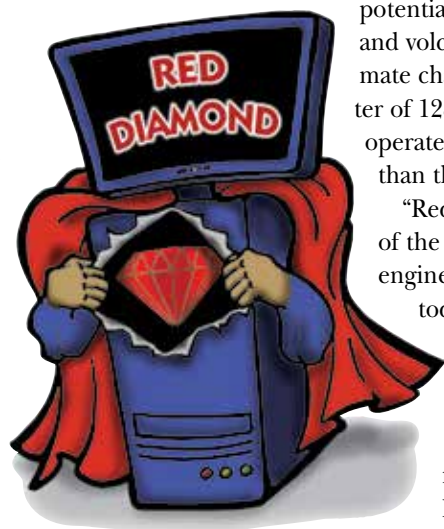
Red Diamond also has been named to a prestigious list as one the most powerful computers in

the world. Twice a year, TOP500 provides an updated list of the world's most powerful computers at corporations, government laboratories and universities. Red Diamond made the list at No. 379 by demonstrating that it could solve a single problem at a speed of 1.349 teraflops.

Today's supercomputers can typically solve a single problem at a rate of more than one teraflop per second. "Flops," or floating-point operations per second, is a complex mathematical calculation to measure the speed at which a computer can process data. "Tera" stands for one trillion, so supercomputers produce one or more trillion computing operations, or steps, per second.

There are also kiloflops (one thousand), megaflops (one million) and gigaflops (one billion). A new, personal computer with a speedy processor operates at three to six gigaflops, or three billion to six billion operations per second.

Supplied by Dell Computers and paid for by a research grant from the National Science Foundation and matching funds from the University of Arkansas, Red Diamond is helping researchers solve challenging scientific and engineering problems. ■



The *Listeria* that Won't Die: How Much Damage It Can Do

Meat processors already know that dangerous *Listeria monocytogenes* bacteria can withstand some major assaults. They sanitize the food processing environment and heat their products to kill the bacteria on cooked and ready-to-eat meats, but a few of the bacteria are merely injured or starved and live to cause trouble another day.

Federal regulations have a zero tolerance standard for *Listeria monocytogenes* in ready-to-eat products, so it's important for processors to find ways to beat back every last bacterium. That means scientists must figure out how much damage the injured or starved bacteria can do if left unchecked.

Unfortunately, the answer is that the bacteria remain virulent even after several months in a starved state according to Ramakrishna Nannapaneni, a food science research associate who works with a research team led by professor Mike Johnson doing research for the Food Safety Consortium.

The experiments tested *Listeria monocytogenes* cells that had been starved for 196 days and those that had not been starved. The healthy cells were strong enough to kill 90 percent of a target mouse cell population within two hours of release. The starved and injured cells,

after more than six months of languishing, still killed 60 percent of their target cell population within six hours, then 90 percent of the target after eight hours.

"Most of the phenomenon is that the starved ones take a little longer to wake up," Nannapaneni said. "Once they wake up, they have the strength to go forward."

This project used mouse hybridoma cells to demonstrate the power of starved *Listeria monocytogenes*. The next step is to test the bacteria on human cell models to discover if they are equally susceptible and how quickly they can be infected. Then it's time to determine what controls are necessary to kill the starved pathogens.

"It's important to understand how these starved cells are waking up and how to suppress them," Nannapaneni said. "The long-term starved cells become smaller and coccoid (spherical shaped), but they still remain viable and virulent." ■



courtesy photo

Ramakrishna Nannapaneni, a University of Arkansas food science researcher, examines starved cells of *Listeria monocytogenes*' impact on targeted mouse cells.

Federal Funding for Domestic Violence Programs Not Reaching Intended Recipients

Federal funding for local domestic violence programs is not reaching underserved areas and people who most desperately need the services.

Researchers studied data from every county in the United States and statistics from national domestic violence program directories and discovered that poor and minority women and women who live in rural areas do not receive the same public services – counseling, access to shelters, legal aid and child-care assistance – as white women who live in affluent areas with a major college or university nearby.

"We found that the funding process favors existing organizations, which may not be the most effective way of reaching communities with the greatest need," said Amy Farmer, economics professor at the Sam M. Walton College of Business.

Farmer, Jill Tiefenthaler, a professor of economics at Colgate University, and Amandine Sambira, former economics graduate student at the U of A, analyzed local and national data to determine whether the Violence Against Women Act, the federal law that protects and assists victims of intimate-partner violence, is effectively and efficiently serving all victims. The researchers' findings were published in the *Journal of Marriage and Family*.

In addition to demonstrating funding inequities based on race, income and geography, the researchers argued that the U.S. Department of Human Services does not have a comprehensive study showing which are the most effective and efficient programs. The absence of such information means the Violence Against Women Act does not specifically target funds to areas and populations with the greatest need.

"We know very little about what services are provided nationally and whether these programs are reaching as many women as possible," Farmer said.

Congress passed the Violence Against Women Act in 1994 and an updated version in 2000 after years of work by grassroots organizations that were influenced by feminist thinking. Prior to the act, a coalition of groups relied on private donations, charities and miscellaneous governmental financing to fight domestic violence. Farmer argues that the history of grassroots organizations, which were concentrated in affluent areas and cities with a major university or college, has contributed to the lack of a "top down" understanding of the needs of domestic-abuse victims nationwide. ■



Researchers Develop Clear Picture of 'Birth' of Semiconductor Nanostructures



Courtesy photos.

This image of quantum dots, above right, was taken using molecular beam epitaxy (MBE) and scanning tunneling microscopy (STM). The system, pictured above, includes three MBEs and three STMs.

University of Arkansas researchers have witnessed the birth of a quantum dot and learned more about how such atomic islands form and grow, using the ultrahigh vacuum facility on campus. This information will help researchers better understand and use materials that could lead to small, efficient and powerful computers, communication devices and scientific instruments.

Seongho Cho, Zhiming Wang, and Gregory Salamo reported their findings in the journal *Applied Physics Letters*.

"We have changed the way people have to think about how nanostructures grow on a surface," said Salamo, University Professor of physics. "People had a different idea of how these islands formed, but until now there was not direct evidence."

The researchers combined the molecular-beam epitaxy machine, which creates material atom by atom, with scanning tunneling microscopy, which can observe

the atoms, to witness the creation of quantum dots, or atomic islands, of indium gallium arsenide (InGaAs) atoms atop a gallium arsenide (GaAs) surface. InGaAs is a material of electronic and optical interest for properties that could enhance communications equipment, computers and electronics.

At the atomic level, a surface is characterized by small monolayer "steps." Until now, researchers believed that the first atom of a quantum dot would land at the base of the step, rather than further out towards the edge of the step. The work of Cho, Wang and Salamo shows instead that the first atom lands at the step's edge.

"An island growing from below the step edge must first build up to a height equal to the step. This is unnecessary since it could more easily just start from the top of the step," said Wang, a research professor working with Salamo.

The researchers found that the first atoms of InGaAs land side by side atop the GaAs surface and experience a strain, much like a person trying to squeeze into an already crowded line. Therefore, after a short time, it becomes easier for an InGaAs atom to land atop other InGaAs atoms instead of on the initial surface. Also, fewer atoms land on a layer as the layers build up, allowing the atoms to have more space and experience less strain. The researchers witnessed this sequential, upward, narrowing growth as they studied the formation of the InGaAs quantum dots, which ended by forming a pyramid-like structure. ■

New Book Documents Blackwell's Architecture of the Ozarks

A mobile home, a candy-colored silo and lush Ozark vistas grace the first pages of the new book on Marlon Blackwell, "An Architecture of the Ozarks," recently published by Princeton Architectural Press. In his work and now in his book, Blackwell celebrates both the natural beauty and what he describes as "the good, the bad and the ugly" buildings of northwest Arkansas, where he lives, builds and teaches at the University of Arkansas School of Architecture.

"This land of disparate conditions is not just a setting for my work – it is part of the work," Blackwell wrote. "In these conditions I do not see a negative, but instead, a source of deep possibilities."

Touted as a "radical ruralist" by the Royal Institute of British Architects, Blackwell has built an international reputation by transforming the ordinary into something entirely new. One can trace the influence of Springdale's chicken feed elevators on the Keenan TowerHouse, an 80-foot-tall private aerie in east Fayetteville. The hybrid BarnHouse in Wedington recalls utilitarian farm structures, its concrete block and metal cladding elevated to art by extensive glazing and the rhythmic symmetry of honey-colored fir detailing. In every case, Blackwell's response to the environment is guided by the passions of his clients, resulting in highly personalized, idiosyncratic architecture.

The book features nine beautifully photographed projects ranging from Blackwell's first residential design to recent more public spaces such as the award-winning

University of Arkansas Opens RFID Research Laboratory

Fifty-year-old technologies rarely have the potential to transform the business landscape. The University of Arkansas and 24 industry-leading companies believe one technology – Radio Frequency Identification (RFID) – can do just that; they have joined forces to create a multidisciplinary neutral, third-party research and testing facility, the RFID Research Center, a subunit of the Information Technology Research Institute in the Sam M. Walton College of Business.

The laboratory will conduct research into efficient use of RFID and other wireless and sensor technologies throughout the supply chain, emphasizing the retail supply chain. At its simplest, RFID consists of a read/write device called a "reader" that is networked to a computer system and one or more tags.

A reader can identify more than one tagged object at one time. Tags contain a computer chip and an antenna embedded into a substrate material. At present, manufacturers and retailers plan to use RFID to track pallets and cases of products from the manufacturing facility, on trucks and in the retail distribution centers and store rooms to increase efficiencies and minimize costs in the supply chain from manufacturer to the store shelf.

"The mission of the RFID Research Center is to create and extend knowledge in the use of RFID and its impacts on business and society," said Bill Hardgrave, holder of the Edwin and Karlee Bradberry Chair and director of the RFID Research Center. "It's hard to believe that a tiny chip, about twice the width of a

human hair, can help companies know what lies in each case, where that case is and where it's going – at all times. That's significant in terms of supply chain efficiencies."

In June 2003, Wal-Mart Stores Inc. asked its top 100 suppliers to begin tagging products at the pallet and case level by January 2005. By August of that year, it expanded the request to include all suppliers by 2006. This initiative, along with a similar move by the Department of Defense, jump-started an entire industry centered on the production and optimal application of RFID technology.

The RFID Research laboratory examines not only technical issues, but also questions of public policy.

"Privacy advocates worry about the potential for companies or others to misuse the data collected from RFID-enabled products," Hardgrave said. "Through our work at the center, we hope to allay these concerns by dispelling popular myths about RFID and better educating the public about RFID." ■



photo by Russell Coltrane

The new RFID research laboratory will enable researchers to help businesses track inventory through the supply chain.

Fred and Mary Smith Razorback Golf Center, an austere form punctuated by bands of windows and enriched by dry stacked stone and copper cladding.

Three essays by David Buege, Dan Hoffman, and Juhani Pallasmaa explore the evolution of Blackwell's style and chronicle his personal mythology. ■

Top right, the BarnHouse in Wedington, Ark., stacks residential space above horse stables.

Middle, the Fred and Mary Smith Razorback Golf Center in Johnson, Ark.

Bottom right, the Blessings Golf Clubhouse in Johnson, Ark.





Who Rocks the Vote?

By Kristy Guttman



Leslie Yingling

Leslie Yingling worries that, when it comes to politics, teens don't worry enough, and her concern led her to examine youth voting patterns in the United States.

"It's really important for young people to vote because when they become the over-30 population, it will be their responsibility to demonstrate to the next young generation the importance of voting and civic activity," said Yingling, a 2005 University of Arkansas journalism and political science graduate.

Yingling was politically motivated from a young age. Her parents voted in every election – not just presidential elections, and Yingling said she remembers waiting outside of the polling place while they voted. The first of four siblings, Yingling was born and raised in a rustic home in Winslow, Ark., that was intentionally absent of preconceived notions of the middle class. Yingling and her siblings went to a small, nearby public school from kindergarten. She graduated early from Winslow High School, where she was enrolled in a senior class of 20, and immediately began attending the University of Arkansas on a Sturgis Fellowship – a \$48,000 four-year award – as an entering freshman in 2001.

Yingling was one of 14 million Americans who turned 18

years old between 2000 and 2004. Despite not being able to vote, the 2000 election was compelling for Yingling.

"When the popular vote lost to the Electoral College, I wasn't turned off of voting. I saw it as all the more valuable and necessary," she said.

Consumed by details of the 2004 presidential race, Yingling was bothered by what she saw as the inherent lack of interest among many fellow college students. Her academic advisers encouraged Yingling's interest in the topic of youth voting.

"We were surprised at how little research has been done on youth voting or non-voting patterns," said Louise Montgomery, associate professor of journalism and Yingling's thesis adviser. Yingling's analysis of youth voting trends is one of few raising important issues.

"The economy hasn't been good. Look at the increase in the cost of education, even though the bachelor's degree is the new high school diploma. They should realize how much it affects them," Yingling said. Still, youth continue to represent declining numbers in voter turnout, she said.

Yingling examined the results of reports and polls on youth voter turnout, comparing the number of youth voters since the minimum voting age was changed from 21 to 18 in 1972.

"Young people are not voting," she said. It is difficult to



Originally published 13 September, 1970. Reprinted 1973, Fisher's Gallery, by George Fisher. Used by permission of Special Collections, University of Arkansas Libraries, Fayetteville.

know whether it is a characteristic of the person or the age group relative to maturity and interest in politics at a young age. Yingling studied U.S. Census data and found that the percentage of youth voters has decreased every year since 1972. Even though the number of youth voters increased in the 2004 election – approximately 48-52 percent of young people between the ages of 25 and 29 voted – the physical turnout did not increase the share of the youth vote since overall voter turnout increased as well.

The youth voter profile is quite different now than it was 30 years ago. Yingling reported that more youth voters identify themselves as hispanic, black and gay, lesbian or bisexual than the rest of the electorate. She also found that the number of youth voters of both genders is more equal when compared to the general electorate.

Yingling wanted to know what issues were encouraging young voters to go to the polls and whether presidential candidates were addressing the issues deemed important by young voters. Yingling's personal highest concern in the most recent election was civil rights; however, her study shows that she was among only 11 percent of 18 to 29 year-olds who expressed the same primary concern. The polls taken just before the 2004 election reported that 35 percent of registered youth voters were most concerned with the economy and jobs; terrorism and national security was ranked most important by 22 percent; the war in Iraq by 15 percent; education by 12 percent; civil rights by 11 percent; and crime and violence by 2 percent.

"We're at war, which affects young people, almost exclusively," Yingling said. Fewer young people vote when the country is not at war than do when the country is at war. The number of voters increased across the board, but the presidential candidates did not pay any more attention to youth voter concerns than they have in the past, according to Yingling's research.

"Wartime and a particularly scary economy happened to coincide with issues across ages" in the 2004

election, she said. The issues addressed by the candidates appear to have been in line with those viewed as important by the youth population, but considering presidential candidates' historical disinterest in attracting youth voters, Yingling concluded that the matching of issues discussed by candidates to youth concerns was merely happenstance.

Yingling also looked at the efforts of nonpartisan Get Out The Vote (GOTV) organizations because their presence was so prevalent in the last election. GOTV organizations blame the lack of attention to the youth vote on "the chicken or the egg" complex – youth aren't voting, so candidates don't address them.

"In the study of democracy you want to see what works and what doesn't work," Yingling said. ■

Hot Spot!

Hot Spot!

Designed by Eric Pipkin
Photos by Stephen Boss
& Melissa Blouin

University of Arkansas researchers are studying the lakeshore processes at one of America's most beloved national parks to help tease out how the lake's ups and downs reflect the movement of a living volcano.

By Melissa Lutz Blouin

The day probably started like any other – birds singing in the trees under blue skies, or perhaps it was rainy. The first sign might have been rumbling, a tremor from the not-so-distant belly of the earth. Or the signal might have come from an ash cloud, spewing dark debris skyward. Then, with little outward warning, the ground exploded, shooting boiling clouds of ash and pumice miles into the sky. By the time the cataclysm ended, over 600 cubic miles of material had ejected from the ground into the air, and layers of ash had fallen thousands of miles away, making Mt. St. Helens look like a polite sneeze in comparison. Every year about three million people go to

Yellowstone National Park to see remnants of these violent eruptions. Geologists have found evidence of several major eruptive episodes – the first 2.2-2.1 million years ago, the second around 1.3 million years ago and the third about 640,000 years ago. Indeed, the West Thumb Arm of Yellowstone Lake was created by a relatively minor explosion about 150,000 years ago. Visitors to today's Yellowstone National Park wander about within a living caldera, a modern-day volcano simmering away beneath the surface.

Yellowstone sits upon a "hot spot," one of about three dozen situated at various points on Earth – a place where the crust has thinned so that hot magma lies close to the surface, at points only an estimated 10,000 feet below the ground. The hot spot is responsible for the cataclysmic eruptions in the past 2 million years – a blink of an eye geologically speaking.

The gushing geysers, funky-sounding fumaroles, colorful pools and quirky mud pots that attract tourists to Yellowstone are the outward signs of the magma's continuing presence. Geologists monitor two domes inside the Yellowstone caldera that swell and shrink over time.



Steve Boss, Professor of Geosciences



John Dennis, Graduate Student



Mo Salem, Graduate Student



Vanessa Heil-Chapdelaine,
Undergraduate Student



Barbara Pickup, Graduate Student

Mt. St. Helens, Washington
1980
0.1 cubic miles

Krakatoa, Indonesia
1983
4.3 cubic miles

Mazama, Crater Lake, Oregon
7,600 years ago
18 cubic miles

2nd Yellowstone eruption
1.3 million years ago
67 cubic miles

3rd Yellowstone eruption
640,000 years ago
240 cubic miles

1st Yellowstone eruption
2.1 million years ago
600 cubic miles of material ejected

“These domes seem to operate somewhat independently of one another,” said Stephen K. Boss, professor of geosciences and director of university’s environmental dynamics program. “But no one understands the dynamics of the movement and processes out here.”

Researchers want to better understand the underlying processes of the Yellowstone caldera because doing so will help scientists understand volcanoes in general and may one day help save lives. And it turns out that in Yellowstone, the lake may have something to say about all of this.

It is a clear August morning in Yellowstone. A pelican glides past the Grant Village marina at the south end of West Thumb Arm of Yellowstone Lake. The sun’s silvery reflection glints off of the water and hits the bright white side of the Research Vessel, Ozark Explorer, a 22-foot Sedan Cruiser that Boss and his graduate students hauled on a trailer behind a white van from Arkansas to Yellowstone. Boss, with doctoral students John Dennis and Mo Salem and undergraduate student Vanessa Heil-Chapdelaine, a Research Experience for Undergraduates student visiting the University of Arkansas for the summer from Washington University in St. Louis, camped for four days on their way to Yellowstone National Park. Once in the park, the UA crew met Barbara Pickup, Distinguished Doctoral Fellow in the environmental dynamics program and 2004 Canon National Parks Science Scholar.

Boss steers the boat to the dock as Pickup and Dennis assist two rangers from Yellowstone’s research permitting office off of the boat. They have been on the water since 6:30 a.m., and it is now 9 a.m. Dennis hands each person a life jacket much like the bright orange one he wears.

He gives a lecture on safety:

“The water’s real cold, now, so don’t fall off the boat,” he says.

Later, as the boat glides across the West Thumb Arm at five miles per hour, Boss elaborates a little on that statement.

“The park rangers told us that if you fall in and you stay with the boat, you’ll be dead in 20 minutes, and if you fall in and try to swim for shore, you’ll be dead in 20 minutes, so don’t fall in,” he says.

Yellowstone Lake is the largest natural freshwater lake in the United States above 7,000 feet and is one of the largest such lakes in the world. The lake covers 136 square miles, is 20 miles long by 14 miles wide and it has 110 miles of shoreline. It is at least 390 feet deep in the West Thumb area and has an average depth of 140 feet. Because of its size and depth and the area’s prevailing winds, the lake can sometimes be whipped into a tempestuous inland ocean. The lake remains cold year-round, with an average temperature of 41 degrees Fahrenheit.

Research at Yellowstone is not for the faint hearted. While in the park, the scientists had to work around bad weather – including hailstorms and flash floods – encounters with bears, illness and occasional equipment failure. They also put in long working hours. They had a lot to accomplish in the two-week window in Yellowstone, so there were no weekends or holidays.

The work on the boat held its own risks, and Boss emphasized that safety always comes first – at the first sign of wind, rain or choppy water, they would get off of the lake. The research on land often meant working on the shoulder of a narrow road where people are paying attention to wildlife and the scenery, so the whole crew wore bright orange mesh vests so they could be easily seen.

The researchers also had to clamber over boulders in the large chunks of rock called “rip-rap” on the side of the road, which is hard on ankles and knees – one misstep could send an unlucky person to the nearest medical facility with a sprained ankle.

But in the West Thumb Basin of Yellowstone Lake on a clear sunny day, with the sun’s mirror-like reflections on the water, all is calm as we work. In the boat’s cabin, black lines snake across the screen of a laptop computer, moving slowly up and down, occasionally splitting into layers, then coming together to form one fuzzy black mark

The computer is recording sound waves as they are bounced off the lake floor from a dual-frequency echo sounder, which is coupled with a Global Positioning Systems antenna to determine the exact location of the depth sounding.

The researchers use both high and low frequency sound waves to determine different things: The high frequency sound waves show sediment lying atop the actual lake bottom, while low-frequency sound waves penetrate lake sediments and depict the lake bottom beneath the sediment. The equipment takes readings of the sound waves about every five feet or so, and each reading has a GPS point attached to it. By scanning across the lake from east to west then north to south, the researchers create a grid of points and depths that allows them to create a detailed digital elevation model of the bottom of the bay – essentially a detailed topographic map of the lake bed.

At the helm, Boss glances occasionally at a small digital screen that contains data from the GPS unit. The screen shows where the boat has already been, “a little trail of breadcrumbs” according to Dennis. That allows them to be sure they are not duplicating data points.

The U.S. Geological Survey has mapped the entire lake bottom, but Boss and his students are creating a more detailed model of selected areas. They plan to combine the information gathered about the lake bed and the lake shore to create a digital simulation of these areas of the West Thumb Arm. Then they will use computer modeling to mimic different types of deformation and sediment movement to see if changes they see in the digital model parallel those they see along the actual lake bed and shoreline. They can then compare what they have created through simulation with historic aerial photos.

“The trick for us is trying to reconstruct events to match the lakeshore documented on historic aerial photos,” Boss said. If successful at linking caldera deformation, lake level and shoreline change, this method could greatly help National Park Service personnel and other researchers track caldera movement, because the lake shore





changes annually by magnitudes of meters, whereas the caldera changes in centimeters.

"It's potentially another way to monitor what the caldera is doing through the lake shore," Boss said.

After visiting the park as a college student in the 1980s, Boss had returned to Yellowstone as an adult for a family vacation with his children in 2003. On this visit, however, something caught his eye that he hadn't noticed before.

He saw that the shoreline of Yellowstone Lake had beaches and sand spits – much like the Atlantic coast he had studied a decade before.

Boss wondered if anyone had ever studied the shoreline processes along Yellowstone Lake, so he contacted the National Park Service and found out that no one had.

"It's the boundary between the lake and the land that was ignored," Boss said.

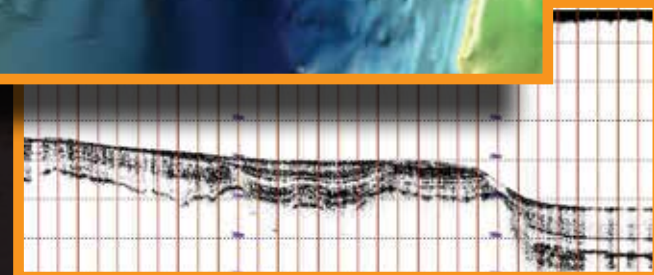
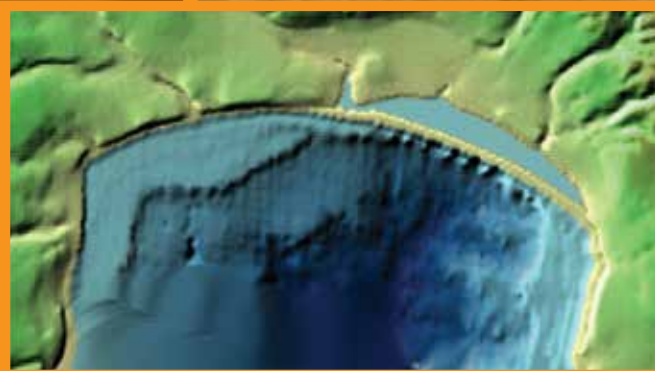
After that visit, Boss and Barbara Pickup, a distinguished doctoral fellow in the environmental dynamics program, began to gather historical photos of segments of the lakeshore along the West Thumb Arm. They chose this particular part of the lakeshore in part because it lies in an inhabited area of the park, and the U.S. Geological Survey and National Park Service had historical photographs of this area of the lakeshore that could be compared to modern-day aerial views.

In 2004, Pickup examined aerial photographs taken from 1954 to 2002 to study shoreline changes. One photo, taken in 1994, had been geographically corrected using Geographic Information Systems to pinpoint the exact location of each pixel, and Pickup used this photograph to calibrate the other photos. She then measured the shoreline in 20-meter intervals to determine the net change from photo to photo. When she and Boss examined the data, they found that overall the shoreline had receded. However, they also found something unexpected.

"We saw a substantial change along the shoreline, and it wasn't uniform around the basin," Pickup said.

Normally, a lake shoreline would advance or recede much like the water in a bathtub – evenly around the whole tub. However, the data from Pickup's study showed one side of the basin receding while other parts remained stable or advanced – and later the processes reversed.

The West Thumb basin and most of Yellowstone Lake sits within the Yellowstone Caldera, the actively deforming crater formed by the violent volcanic eruptions of the past. The lakeshore changes might reflect changes in the caldera Boss said. However, other processes such as variation in lake level or redistribution of sediment along the shoreline could be responsible for the lakeshore changes, too. Determining which combination of these factors causes the shoreline to change is the focus of Pickup's dissertation.



The National Park Service has an interest in better understanding shoreline erosion for several reasons: First, because it may affect archeological sites along the lakeshore and a rare, endangered flowering plant found nowhere else in the world, and second because it may affect infrastructure built alongside the lake, such as roads.

"The lake has been used by humans for 10,000 years and continues to be a popular spot for present-day tourists," Pickup said.

This year marks the second summer that Pickup has spent in the park. Last summer, she and Boss used high-resolution computer equipment to scan and measure the shoreline studied in the aerial photographs at three sites in the West Thumb basin. This year, they returned to the same sites to perform scans again. Pickup received a \$78,000 fellowship from the Canon National Parks Science Scholars Program to fund her dissertation.

With the scans from last summer and this summer, the researchers hope to determine what changes have taken place over the course of one year.

"Using this scanning equipment, you can see individual pebbles along the shoreline," Pickup said. "If something changes, we're going to see it."

In addition to hitching the boat to the back of the van, the research team hauled along a mass of on-the-ground equipment to use for making detailed maps of the lakeshore. They brought along the High Accuracy/Resolution Landscape and Structure Characterization System, better known as HARLS-CS – an integrated suite of high-technology laser scanning devices housed in the Center for Advanced Spatial Technologies (CAST).

HARLS-CS was used to create detailed images from the edge of the lakeshore to the top of the bluffs lining the shore. For her research, Pickup is looking at three sites in the West Thumb arm of the lake: Osprey Beach, among the oldest known archaeological sites within the park; and East and West Arnica, named for Arnica Creek, which runs into a lagoon on the north side of West Thumb.

Pickup and environmental dynamics graduate student Mo Salem set up two tripods, one for the laser scanner and the other for GPS, to pinpoint the exact location of each image. Then Salem calibrates the laser profiler using GPS and sets up a scan that will create three-dimensional images of every rock, every tree branch and every pile of dirt. The scans reveal detail down to about a centimeter – enough to determine if the lakeshore has receded or advanced, or if there have been landslides and erosion.

As Pickup, Salem and Boss worked in the park last summer, Boss noticed that some of the roads along Yellowstone Lake hugged the shoreline and were supported by rip-rap – large stones brought in to shore up the road against lake erosion. This year, environmental dynamics graduate student John C. Dennis began work on yet another project at Yellowstone Lake – using GPS and other scanning and

Left page, from top: A dual-frequency echo sounder takes readings from the lake bed. The GPS unit to the left helps keep the boat on track. Geosciences professor and his crew aboard the Ozark Explorer on Yellowstone Lake get ready to come ashore. The result of the work done on the boat is a detailed digital elevation map of the lake bed, created from hundreds of black-and-white computer scans, each of which represent a slice of the lake bottom.

This page, from top: A beach-like spit juts out into the lake at East Arnica, where the researchers scanned the shoreline to look for changes. Changes found in historic photos point to a possible link between lake level and caldera movement. Below, the researchers also studied at Osprey Beach, a site important for its archeological artifacts, the oldest found in Yellowstone National Park.





mapping technologies to determine changes in the erosion processes when the natural shoreline is replaced with rip-rap.

At some locations, the road runs adjacent to the water, with rip-rap starting less than 10 feet from the shoreline. At other locations, the rip-rap is the shoreline.

One morning illustrated the unexpected issues that field research presents. As the van stopped at the first survey location, someone spotted a brown dot lumbering down a hill until it finally became a bear. The bear zig-zagged down the hill until it was relatively close, a huge group of cars began to slow down or stop, and people began pouring out of them to gawk and take pictures.

It is not wise to turn your back on a bear, so after determining that the bear wasn't going to go away, the researchers moved the van a mile or so to another pull-out and began to unload equipment. While they were doing so, Pickup called a park ranger to report the "bear jam," which was causing traffic problems. All the researchers put on bright orange mesh vests to alert cars to their presence.

As they set up

the equipment, another problem arose: The memory card used to record data from the GPS unit was not recording properly. Despite this setback, they were able to continue to gather data – they just couldn't have the computer do all the calculations for them. This meant the researchers had to take down the GPS coordinates individually and do some of the calculations by hand using trigonometry to be sure they were correct.

Above, top: Graduate students Barbara Pickup and Mo Salem set up the equipment that allows them to scan the shoreline. They scanned the same sites two years in a row. "Using this scanning equipment, you can see individual pebbles along the shoreline," Pickup said. "If something changes, we're going to see it." Left and right: Graduate student John Dennis uses a reflector to determine the slope of the beach, the rip-rap and the slope of the lake bed off shore. This information can be used to determine if rip-rap, shown at center, right, makes beaches erode faster than they do when left alone, far right.

Dennis and Salem used a laser range finder to map the location of the rip-rap. Then Dennis donned an insulated wet suit and hauled a large pole with what looked like a silver pizza pan out into the water. The range finder shoots a laser like a gun at the pizza pan reflector. By pinpointing the exact location of the reflector, the distance and height of the reflector can be calculated. From this information, the researchers can determine the slope of the beach, the rip-rap and the slope of the lake bed just off shore.

"We want to see if the road engineering is influencing how the beaches and the lake bed are evolving," Dennis said.

Natural beaches usually have a gradual slope to the shoreline, which allows waves to dissipate energy when they come ashore. However, when waves reflect off the rip-rap, they don't lose much energy, and may scour out and deepen the lake bed just off shore, changing the nature of the shoreline and causing it to erode, Boss said.

If the shore erodes, then more rip-rap will be needed, taking the lakeshore further away from its natural state.

"Then the reason that you created access to the lake isn't there anymore," Boss said.

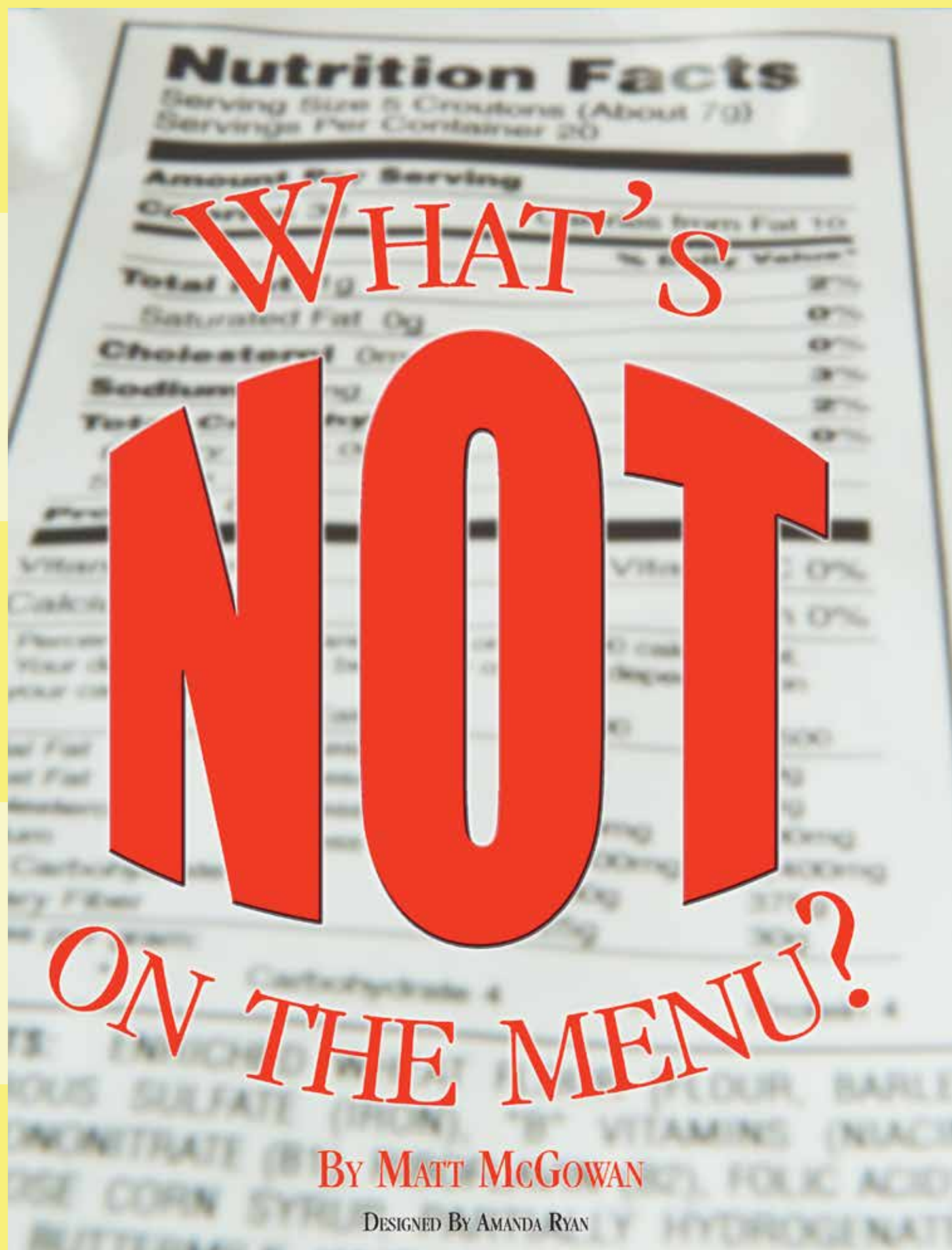
The researchers plan to compare the lakeshore processes at shores with rip-rap to the lakeshore processes at undisturbed beaches to see what kind of impact the road may be having on the shoreline.

"It's something the park service will constantly have to deal with," Dennis said.

The National Park Service has a two-fold mission, both to be responsible stewards of the natural resources in Yellowstone and to ensure the public enjoyment of those natural resources. Knowing how man-made structures will affect the natural resources and knowledge about the historical processes of the caldera offer the Park Service more pieces of information that they can use to make informed decisions that affect the park's future. ■



Above: Two photographs of Fishing Cone Geyser, West Thumb Geyser Basin at Yellowstone Lake show the large changes in lake level over the past century. The first photo was taken by J.E. Haynes in 1892. The second one was taken by Boss on July 31, 2004. "Clearly, present-day lake levels are significantly higher than a century ago, presumably due to caldera dynamics or climatic variability or a combination of these factors," Boss says.



Americans consume 54 billion meals a year at fast-food and table-service restaurants.

This means that, on average, they eat a meal outside the home about every other day. Research has shown that these meals have contributed to the rise in obesity.

Scot Burton and Betsy Creyer are willing to bet that if Americans knew the number of calories and amount of fat and sodium in many meals consumed outside the home, they might choose a more nutritious menu item. They aren't psychologists, but Burton and Creyer think many people would consider modifying their behavior if restaurants provided nutrition information on menus and menu boards. The information could help consumers make wiser decisions about the type of food they eat, which in turn could have an overall positive impact on public health.

For the past several years, Burton and Creyer, marketing professors in the Sam M. Walton College of Business, have studied consumer knowledge and attitudes about food purchased at McDonald's, Subway, Chili's, Applebee's and scores of other establishments in which Americans eat more than half their meals and spend more than \$400 billion annually. Specifically, Burton and Creyer examine the potential health benefits associated with providing nutrition information and the effects that information could have on consumer perceptions about health and disease.

In two recent studies, they investigated the accuracy with which consumers estimate the nutritional content of restaurant meals and how consumer attitudes about those meals change when nutrition information is provided. The researchers made two important discoveries.

A majority of people consistently underestimate the number of calories and amounts of unhealthy nutrients in the food they eat at restaurants. This is especially true for diners who prefer hamburgers and fries, baked potatoes loaded with cheese, sour cream and bacon bits and other meals with many calories and a lot of fat and sodium.

"Our findings illustrate how poorly consumers understand the nutritional content of many of the meals they eat outside the home," Burton says. "Reasonable consumers know that a large number of these items aren't healthy, but they still do not realize how unhealthy the meals can be and the possible effects of frequent, long-term consumption."

Perhaps more importantly, Burton and Creyer discovered that when consumers are given specific and objective nutrition information about "unfavorable" meals – those high in calories, fat and sodium – they regard those meals unfavorably. In other words, if consumers know fettuccini Alfredo has 1,500 calories and 97 grams of fat – more than 30 grams above the recommended daily amount – their attitude about that dish changes for the worse.

They perceive the meal to be less healthful and more likely to contribute to obesity and heart disease. The nutrition information also motivates them to change their purchase behavior.

"When we tell them how many calories or how much fat the food has, they get it," Creyer says. "They see this and say, 'Oh my gosh, I didn't know. I didn't know it had so much fat.'"



Scot Burton and Betsy Creyer

Who cares? So what if your Big Mac or Whopper has almost twice as much fat as you think? Does it really help to know that your turkey sandwich with mustard instead of mayonnaise has slightly fewer calories than you think it has? Several facts underscore the relevance of Burton and Creyer's research:

More Americans are eating out more often. They eat 54 billion meals a year at fast-food or table-service restaurants. That's more than a billion meals every week. On any given day, Americans spend more than \$1 billion on restaurant food. According to the National Restaurant Association, American consumers will spend about \$476 billion in 2005 on meals purchased and consumed outside the home. Approximately half of all the money Americans spend annually on food is spent in restaurants.

Also, Americans are fat. Recent reports indicate that almost two-thirds of all adults in the United States are obese or overweight. According to the Centers for Disease Control and Prevention, obesity rates for adults doubled between 1980 and 2000. During this same period, overweight rates doubled for children and tripled for adolescents.

Americans are sick and dying because they are fat. While public health officials and policymakers have softened assertions that obesity alone is an epidemic, there is no doubt that obesity has a positive connection to type 2 diabetes, cardiovascular disease and other chronic illnesses. Initial figures of death rates due to



obesity were overestimated, but David Satcher, former U.S. Surgeon General, has warned that obesity will soon be the leading cause of preventable death in the United States.

Obesity hurts the U.S. economy. In 2003, an estimated \$75 billion in health care costs were attributed to obesity. The CDC reports that from 1979 to 1981, U.S. hospitals spent \$35 million treating obese and overweight children and adolescents. From 1997 to 1999, hospital costs for the same population groups soared to \$127 million.

There are direct connections between the consumption of restaurant food and the rise in obesity. One recent study found a significant relationship between frequent fast-food dining and increases in body weight and insulin resistance, the two primary risk factors for type 2 diabetes.

Some large restaurant chains understand this connection and have exploited it as powerful marketing strategy. Subway, the fast-food chain with 23,741 restaurants worldwide, encourages customers to choose one of seven sandwiches with only six grams of fat. Chick fil-A, encourages consumers to “eat mor chikin” if they’re counting carbs, fat or calories.

Despite the health claims, restaurants, unlike producers of packaged food for sale in grocery stores, are not required to disclose nutrition information. However, this could change. Rep. Rosa DeLauro of Connecticut and Sen. Tom Harkin of Iowa have introduced the Menu Education and Labeling Act (MEAL), a potential sibling of the Nutrition Labeling and Education Act (NLEA), the 15-year-old federal law that led to the ubiquitous Nutrition Facts label on packaged food sold in markets, convenience stores and vending machines. If passed, MEAL would require table-service restaurant chains with 10 or more outlets to disclose calories, saturated fat and sodium levels on menus. Fast-food chains would be required to provide calorie information only adjacent to items on menu boards, the large, often-lighted signs near counters where customers order food. Some states, including Arkansas, have drafted their own bills based on MEAL’s language.

For their first study, Burton and Creyer asked participants to estimate the number of calories and amount of fat, saturated fat and sodium in nine popular entrees served in dinner-house restaurants. Before estimating the number of calories and nutrient levels, participants were given brief descriptions and serving-size information for each meal.

In designing the study, researchers selected meals that they categorized as “favorable,” “unfavorable” and “very unfavorable.” Favorable items – chicken breast, pot roast and turkey sandwich – contained no more than 640 calories and 26 grams of fat. Unfavorable items – fettuccini Alfredo, hamburger and fries, chicken fajitas, chef salad and patty melt and fries – ranged from 930 to 1,660 calories and from 63 to 97 grams of fat. One very unfavorable item, cheese fries, had 3,010 calories and 217 grams of fat.



Differences between estimated levels of calories and nutrients and actual levels varied greatly depending on the meal category. Most importantly, for the six unfavorable meals, participants consistently and significantly underestimated the number of calories and amount of fat, saturated fat and sodium. In other words, calories, fat and sodium in less favorable meals such as hamburger and fries and chicken fajitas are much higher than consumers expect.

For example, participants on average thought a large hamburger and fries had 777 calories, 37 grams of fat, 17 grams of saturated fat and 523 milligrams of sodium. The meal actually had 1,240 calories, 67 grams of fat, 29 grams of saturated fat and 1,270 milligrams of sodium. In other words, people may have a vague idea that a hamburger and fries isn’t good for them, but they have no idea that that meal alone contains more grams of fat and saturated fat than the recommended daily allowance for adults.

For the three favorable items, consumers either slightly underestimated or even overestimated the number of calories and amount of undesirable nutrients. For example, on average participants estimated a turkey sandwich with mustard instead of mayonnaise to have only 12 fewer calories than it actually has. Also, they thought the sandwich had nine more grams of fat and five more grams of saturated fat than it actually has.

“We hypothesized that a greater percentage of consumers would underestimate calorie and nutrient levels for the meals with more unfavorable nutritional content,” Burton says. “The data confirmed this prediction. The accuracy of estimates for the more favorable items shows us that people who prefer more healthful meals probably have a more realistic idea about the level of undesirable nutrients, such as fat and saturated fat, in those meals.”

In fact, the researchers found that the more unfavorable an item in terms of undesirable nutrients, the larger the gap between consumer expectations and actual nutrition levels. For example, consumers underestimated the only “very unfavorable” item – cheese fries, which had 3,010 actual calories and 217 actual grams of fat – by 2,141 calories and 177 grams of fat. They underestimated “unfavorable” items by an average of 642 calories and 44 grams of fat. For “favorable items,” participants underestimated by an average of only 43 calories and overestimated by an average of eight grams of fat. Another way of saying this is that 97 percent of the participants underestimated the grams of fat for a very unfavorable item, 90 percent of the participants underestimated the grams of fat for an unfavorable item and only 37 percent of the participants underestimated the grams of fat for a favorable item.

Knowing that consumers are generally unaware of the high levels of undesirable nutrients in restaurant meals, Burton and Creyer then asked: What are the potential health benefits associated with providing nutrition information on menus? They predicted that access to nutrition information would influence consumer purchase intentions and perceptions about the likelihood of weight gain and heart disease.

Participants in this portion of the study received a survey and mock menu with four items: deluxe hamburger with fries, chef salad, turkey sandwich and chicken breast with baked potato. They also received information on the daily value recommendations for fat (65g), saturated fat (20g) and sodium (2,400mg), based on a 2,000 calorie diet.

The researchers designed this part of the study to simulate the consumer experience if MEAL or similar legislation requiring the provision of nutrition information were passed. Some participants received menus with calorie and nutrient information next to each meal choice. Others received menus with calorie information only, simulating menu boards, and a third group received menus without any calorie or nutrient information.

Burton and Creyer asked participants to choose a menu item and, with the nutrition information provided, explain the choice. Also, participants were asked to share perceptions about the likelihood of weight gain and heart disease as it related to choosing one product instead of another on a regular basis.

The researchers discovered that providing calorie and nutrient information increased choices for the turkey sandwich, the item with the fewest calories and least amount of fat and saturated fat. Likewise, the provision of nutrition information caused partici-

pants to decide against meal items with calorie and nutrient levels that were worse than expected. Burton and Creyer emphasized, for example, that choices for the hamburger and chef salad items decreased from 37 percent to 24 percent when the number of calories and amount of fat, saturated fat and sodium were provided.

Furthermore, for those participants with menus that did not include nutrition information, the researchers could not find a marked difference in perceptions about weight gain and heart disease between the turkey sandwich, chef salad and chicken with potato. However, when the information was present, there was a large difference in disease-risk perceptions.

What about fast food? Do consumers consider the nutrition content of the meals they eat at Burger King, Subway, Sonic, Taco Bell and scores of other establishments Americans patronize on their lunch breaks or on the way home from work?

Previous research by Burton and Creyer demonstrated that consumers generally can distinguish the relative healthiness of one meal compared to other meals. In other words, most reasonable consumers know that a grilled chicken sandwich is better for you than a Big Mac. But, do they know how healthy or unhealthy these items are? How accurate are their expectations of nutrition content, and would point-of-purchase nutrition information

change consumer attitudes about specific meal items?

To answer these questions, the researchers conducted a follow-up study of consumer experiences at fast-food restaurants. A new group of subjects – 155 undergraduate students – were asked to maintain a diary of their purchases at fast-food restaurants over a one-week period. Researchers then asked the participants to estimate the number of calories and amount of fat, saturated fat and sodium for each meal purchased.

In the third stage of data collection, participants consulted the restaurants’ Web sites to obtain actual levels of calories and nutrients. Finally, researchers asked the students to repeat their ratings for the meals. Specifically, they were asked to report their perceptions of meal healthiness, likelihood of gaining weight and heart-disease risk and the likelihood that they would repurchase those meals.

The fast-food study confirmed findings of the dinner-house study and answered several other questions. Most importantly, results of the subsequent study illustrated how poorly consumers understand the nutritional content of many fast-food meals. The researchers found that con-

sumers significantly underestimate calories and levels of undesirable nutrients in meals that contain a lot of those nutrients.

This was especially true for young men. The researchers discovered that male participants eat at fast-food restaurants more than four times a week and, as predicted, offered estimates of nutrition content that were more inaccurate than those estimated by the female participants. In other words, young men eat fast food more often than young women and have a poorer understanding of how unhealthful the fast-food meals they eat are. Male participants thought the average meal contained 324 fewer calories than it actually had. They also underestimated the amount of fat in the average meal by 14.7 grams.

“For the week, this suggests that male participants consumed a full day’s worth of fat and some 1,400 calories they don’t know about,” Burton says. “This would project to more than 72,000 calories annually. This number of unknown calories per week is clearly capable of resulting in significant long-term weight gain if the consumption was not modified over time or counterbalanced by a significant amount of exercise.”

For all participants, knowledge of specific nutrition information about unfavorable fast-food meals led to unfavorable evaluations of those meals. In other words, with access to nutrition information for meals with high levels of undesirable nutrients, participants regarded those meals as unhealthy and thought the meals would increase the likelihood of weight gain and heart disease. Access to the information would also decrease their intentions of purchasing the meal again.

However, the researchers emphasized that participant exposure to nutrition information for lower calorie meals led to no significant changes or more favorable evaluations of those meals. Burton says this finding could result in market advantages for restaurant chains serving lower calorie meals.

Burton and Creyer’s research shows that attitudes about unhealthy meals change when consumers have access to specific information about calories and undesirable nutrients contained in those meals: Perceptions are more unfavorable or negative. Consumers think less of the meals, but does this mean they would choose a different, more healthful meal? Would they say, “I’ll have a grilled chicken sandwich without mayonnaise” instead of “I’ll take a Whopper, a large order of fries and chocolate milkshake”?

The researchers think many people, particularly those concerned about their weight or health, would modify their behavior and pick the chicken sandwich. They argue that disclosure of nutrition information at the point of purchase may reduce consumer choices for higher calorie, less nutritious items and may even lead to restaurants offering more nutritious meals.

“There’s a segment of the population that wants this information to be available,” Burton says. “And there’s a segment of the population who couldn’t care less. But, for those who do care, our findings suggest significant long-term health benefits may be obtained by providing nutrition information on menus and menu boards.” ■

BURGER BARN*		
Item	Calories	Price
SANDWICHES		
JR. HAMBURGER	280 Cal.	.89
JR. CHEESEBURGER	330 Cal.	.99
DOUBLE CHEESEBURGER	470 Cal.	1.89
FRIED CHICKEN SANDWICH	550 Cal.	2.89
GRILLED CHICKEN SANDWICH	450 Cal.	2.89
SIDES		
FRIES (lg.)	540 Cal.	1.65
FRIES (sm.)	210 Cal.	1.05
ONION RINGS	800 Cal.	1.95
DRINKS		
CHOCOLATE SHAKE	770 Cal.	2.35
COLA (lg.)	330 Cal.	1.35
DIET COLA (lg.)	0 Cal.	1.35

*Calorie Counts are reasonable estimates based on nutrition information obtained from the Center for Science in the Public Interest. Actual calories vary, and depend on ingredients, portion size and the manner in which food is prepared.

WHERE ARE THOSE EXTRA POUNDS COMING FROM?



How much weight are Americans gaining by eating one “unfavorable” meal – a meal high in calories, fat and sodium – in a dinner-house or table-service restaurant each week? These meals likely contain approximately 600 more calories and 44 more grams of fat than many consumers think. If this is true, an individual is taking on an extra 30,000 unknown calories and slightly fewer than 2,300 grams of fat per year. Assuming that individual exercises as much as the average American and watches the same amount of television as the average American, the consumption of these calories and fat alone could cause the individual to gain up to nine pounds a year.



PUTTING TASTE to the TEST

by Barbara Jaquish

What did you have for lunch today? A chicken breast? A cup of yogurt? A ready-to-drink diet shake? If you enjoyed your lunch, you may have thanked the cook or decided to buy that brand again. What you probably didn't realize is how much you might owe a laser sensor, a puff of air and a panel of experts for your tasty meal.

In Jean-Francois Meullenet's laboratory at the University of Arkansas, people taste food, all sorts of food, and their likes, dislikes and insights can lead to millions of good lunches, with yogurt that appeals to American palates and consistently tender chicken. The rheology and sensory research program coordinated by Meullenet, an associate professor of food science, addresses the challenges the food industry faces and provides basic information on the sensory qualities of food – factors such as appearance, aroma, flavor and texture that add up to a satisfying meal. Meullenet weighs the opinions of average consumers and the conclusions of a professional descriptive panel to develop sophisticated analytical tools usable in product development or in a food-processing plant.

Three decades ago, Meullenet explained, food testing was frequently used without a clear idea of what the industry was trying to achieve.

"Over the years, the field has developed into a science with a set of methodologies, and the food industry is beginning to recognize the sensory scientist as an integral part of the team," he said. "We bring important information to the development of a new product or process."

For each research project, a consumer panel is assembled from a database of 1,500 individuals who have completed a questionnaire detailing personal information and consumption habits. Consumer panelists are asked for opinions and are not asked to be descriptive.

Experience has shown that 60 consumer panelists are sufficient for a valid sample, although at times the researcher may request more panelists to match a previous research sample. Because the database is rich with details

of likes and dislikes, researchers can assemble a consumer panel with a relatively narrow focus. For example for a recent panel, the lab was able to find 65 consumers who like to drink muscadine juice.

In 1996, the UA sensory research program added a professional sensory panel, which has now grown to 15 professionals trained to quantify sensory features of foods. The panel uses a particularly flexible method, Sensory Spectrum Profiling, which allows them to describe a wide range of foods—meats and dairy products, fruits and vegetables, and grains—and to quantify their responses. The University of Arkansas is one of only a few universities in the nation with a professionally trained descriptive panel to conduct flavor and texture profiling.



Water, crackers and applesauce: sensory lab manager Tonya Priesmeyer prepares sample trays for the professional testing panel.

a particular brand. Setting up the yogurt taste-test presented particular challenges. On one hand, researchers wanted to leave the yogurt in its original container, in case the cup affected any aspect of the sensory experience. On the other hand, each yogurt brand can be identified with a particular cup shape and size. The lab staff devised a bulky cardboard holder that masked the shape of the original cup and offered an opening just big enough for a tester's spoon.

The professional sensory panelists have an entirely different job than the consumers. Professional panelists don't talk about likes and dislikes. They pay close attention to what they perceive and to quantifying what their senses tell them about a product. How sweet does it taste? How much musty aroma do they detect? How chalky is the texture—a 6.0 or a 7.5?

Profiling begins with the panel as a group developing a ballot of descriptive terms particular to the subject product along with a group consensus of how to rank the intensity of each factor, using agreed-upon reference points. Later during the actual testing, panelists will work individually and without conferring with each other to assign an intensity rating for each factor based on the references.

During one ballot development, lab manager Tonya Priesmeyer walked the professional panel through referencing for textures. In an earlier meeting, the panel had

flour. Not everyone immediately perceived the chalkiness, and other panelists jumped in with suggestions: "Try feeling it on your front teeth." "Or back teeth." "I use my palate."

Erin Long, a professional sensory panelist with 12 years' experience, says that putting together the ballot is the most difficult and time-consuming part of the work. They must develop a heightened awareness of what they are actually eating and smelling, not what they might think is there. Panelist Brenda Birkinshay, a 13-year veteran, has seen how the mind can be tricky.

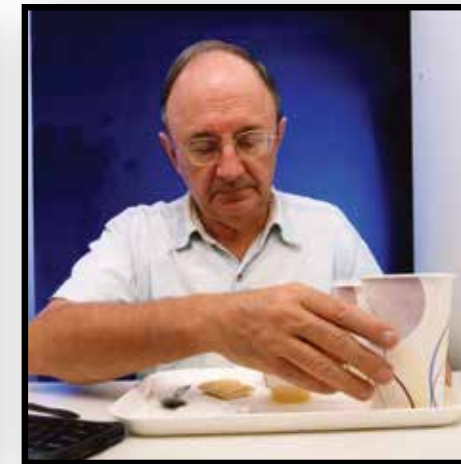
"Sometimes people associate food from the past with what they are tasting. Like with turkey, they think there must be sage," she said.

At the same time, associations are important in isolating characteristics.

"When we're making references," Birkinshay said, "people may say 'It tastes like fresh green beans' and then the staff brings in green beans so everyone can understand the references."

While panelists do their best to arrive at consensus, Birkinshay has learned that complete agreement is not always possible or necessarily desirable. Besides being able to reach consensus with others, a good panelist also must be able to hold on to independent observations.

"We always have an 'other' category on the ballot. It makes people think that it is okay to stick to your guns. New



YUMMY? OR CHALKY?

Most people popping the top of a ready-to-drink shake or pulling the plastic cover off a cup of yogurt are looking for a snack that tastes good, and their response might be "yum" or "yuck" or something in between. When the sensory science lab brings in a consumer panel, that is basically what they are asking the individuals to do—taste several samples of a type of food and

state their preferences. When testing yogurt, the lab looks for people who buy and eat yogurt, because someone who doesn't like the product and gives consistently negative responses can't help make distinctions between preferences for one sample of yogurt over another.

The lab staff goes to great length to insure the anonymity of product samples, so that both consumer and professional testers are focused on what they are tasting here and now, not the associations they might have with

identified a host of tastes, aromas and textures related to a ready-to-drink diet beverage. As graduate students distributed trays of samples, Priesmeyer led a discussion of the comparative degrees of various aspects of texture.

They began with the descriptive term "chalky." To understand the beverage's degree of chalkiness, one panelist suggested thinking of how blended yogurt feels in the mouth with tiny particles, almost like dust or

people get confidence, and they're sticking to their guns."

Once everyone could feel the chalkiness of blended yogurt, the panel had a reference point: blended yogurt has been assigned an intensity of 7.5 for chalkiness. Then panelists sipped about half a spoonful of the beverage sample, sat thoughtfully for a moment and jotted down a number. A quick review of the ratings assigned by the panelists showed that they had achieved a similar

understanding of the levels of intensity for chalkiness and produced an average number for future reference.

In the same way, they established references for other features of texture, such as “mouth coat,” the amount of residue left after expectorating a sample, or “viscosity,” the rate at which the sample flowed into the mouth. Throughout the process, the panelists talked with each other and lab staff, requested additional samples for reference points and worked to translate what they were experiencing when they took the food into their mouths.

During sensory testing, the room was very quiet. The time for consensus was past, as each panelist made an individual assessment. This time the subject was muscadine juice, and the panel considered factors related to taste, aroma and aftertaste. In addition to a sample of juice, each panelist’s tray contained cups of reference substances, such as a solution of sucrose, as a reminder of the standard intensity ratings. At times, the process looked like a wine tasting, albeit with plastic cups, as panelists sniffed and swirled the juice samples. Then a sip, a thoughtful moment, and a quick expectoration followed by noting a number on the ballot. A woman pinched her nose to isolate elements of taste from aromatics. A man stopped to think, checked back with one of the references, and made his judgment.

PREFERENCE MEETS PROFILE

Meullenet brings an unusual set of interests and skills to sensory research. He earned a doctorate in food science and technology at the University of Georgia, which has a large research center. His undergraduate degree, from a French university, is in mathematics, and his food science training was in food engineering. He is particularly interested in statistics and in understanding how to use data to make decisions – an uncommon focus among food scientists.

Meullenet uses advanced modeling techniques to correlate the professional panel’s numbers and consumer

panel’s thumbs-up and thumbs-down. Preference mapping identifies the optimal sensory profile of a particular product. The results guide the development of better food products or of efficient instrumental methods for predicting the sensory properties of a food, methods that industry employees can use in the factory or mobile lab to make informed decisions and monitor quality. For example, instrumental methods incorporating advanced modeling techniques such as artificial neural networks and fuzzy logic can be used to predict food texture from mechanical measurements.

TENDER ENOUGH?

If Meullenet and his staff joined you for lunch, you might see them chewing their chicken thoughtfully with one question in mind: Is it tender?

The increased demand for skinless, boneless chicken breasts has presented the poultry industry with the problem of toughness. How do they make sure that the package of chicken breasts you pick up at the grocery store will consistently have four tender filets? Meullenet explained that tough chicken breasts are a product of modern chicken processing meeting the demand for a particular piece of the bird.

“Fifty years ago there was no problem with tenderness because we cooked the whole carcass at once, as a roast or boiled chicken. When a filet is cut from the carcass too early, the piece will be tough,” Meullenet said.

Immediately after the chicken is killed, there is still energy in the carcass that causes contraction of muscles. As long as those muscles are still attached to bone, as they are with an intact carcass, then there is resistance to the contraction and the muscles relax gradually. But if deboning takes place before the muscles have relaxed, the meat of the chicken breast will be tough.

“We began with a large consumer test to determine what is an acceptable tenderness in a chicken breast, because to tell the industry ‘this is as low as you can go,’



Jean-Francois Muellenet, left, and Mark Swaney fine-tune their simple machine for testing filet tenderness.

we needed to anchor it somewhere by using a preference test and a sensory test,” Meullenet said. “We quickly learned that nothing is *too* tender.”

Correlating the results of consumer testing and the professional panel’s results showed that deboning a bird four to six hours after killing produced an acceptable rate of tenderness, especially when the time stretched toward six hours. But it quickly gets more complicated. Four to six hours doesn’t fit well with the demands of the poultry processing plant. To keep the processing line moving briskly and smoothly, the industry would like to debone birds at two hours. Meullenet said that food scientists have learned that two hours is “the absolute worst time” if the goal is tender chicken.

The problem then became how to meet the goal of providing consumers with consistently tender chicken breasts while running an efficient processing line. It turns out that birds dissipate their leftover energy at different rates, so 50 percent are ready to be deboned at three hours. The question is, which 50 percent?

Meullenet and colleague Casey Owens, assistant professor in poultry science, considered ways to test the bird on the line to determine tenderness. Meullenet assumed that the contracted muscle might reflect light differently than the relaxed muscle. And using near infrared reflectants, that is, sending a beam of infrared light to the surface of the meat and measuring the wavelength, worked well. Unfortunately, the cost per production line made this solution too costly to implement.

Then their students gave him an idea: The students were processing a lot of chicken in the lab and had made a game of predicting toughness.

“They were doing reasonably well. So, I asked them how they based their decisions. It was the bulges and firmness,” Meullenet said.

With that information, he began to concentrate on the filets and on finding a way to measure their shape and firmness during processing. By using a laser distance sensor, the researchers have been able to test the shape of the filet with 80 percent accuracy. To be commercially useful, they needed to get better than 90 percent accuracy, and to do that they needed to measure firmness. Touching the filets with a contact probe presented a food safety

A FLASH OF LIGHT +

A PUFF OF AIR =

A TENDER BITE OF CHICKEN

issue, so that was ruled out. Firmness, they discovered, can be determined by a simple puff of air. In a procedure similar to the standard air-puff eye test, a jet of air shoots at the filet to measure deformation.

Meullenet contacted Mark Swaney, a research associate with the UA Engineering Research Center, who designed a simple machine to simultaneously beam a laser sensor and shoot a puff of air. They are fine-tuning the process, running samples and tweaking logarithms to work towards increasingly accurate classification with a system that accommodates the restrictions of the processing line. In the end, they hope to see four tender chicken breasts in each grocery store four-pack.

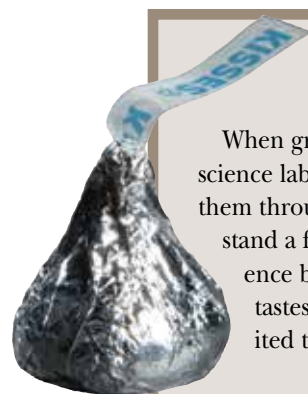
FRIENDLY SOFTWARE

Because the people who monitor food quality don’t typically have Meullenet’s background in statistics, he and Rui Xiong, a post-doctoral associate, are developing a user-friendly software system. Running under the readily available Excel application, the software allows industry employees to use familiar sensory language, rather than statistical language, to analyze sensory data.

“The original software work was done with a post-doctoral student and a graduate student. It is difficult to find the type of student interested in this area because it really requires a statistician, and they are not always interested in food science,” Meullenet said.

To further develop the software, he has shared portions of it with researchers in the United States and internationally. Of the 150 copies he has distributed, one went to a luxury car manufacturer, which has applied the software to its own consumer and expert testing aimed at determining the optimal engine sounds for luxury vehicles and sports cars.

From beginning to end, the work of the rheology and sensory research program is based on people. The preferences of average people are quantified by the descriptions of professional testers and correlated through advanced mathematical modeling to develop practical tools for food processors, all with one goal. In the end, it all comes back to producing a satisfying lunch. ■



THE KISS TEST: YOU CAN PRACTICE SENSORY TESTING

When groups of school children visit the sensory science lab, Tonya Priesmeyer, lab manager, leads them through this simple and fun exercise to understand a fundamental of sensory testing, the difference between basic tastes and aromatics. Basic tastes are perceived on the tongue and are limited to sweet, salt, sour and bitter. Everything

else is an aromatic and depends on the sense of smell. Priesmeyer instructs the children to close their eyes and pinch their nose. She puts a piece of chocolate on their tongue and asks them what they taste. The answer is “sweet.” When they let go of their noses and breathe, the familiar flavor is immediately evident, and they all pronounce it “chocolate!”

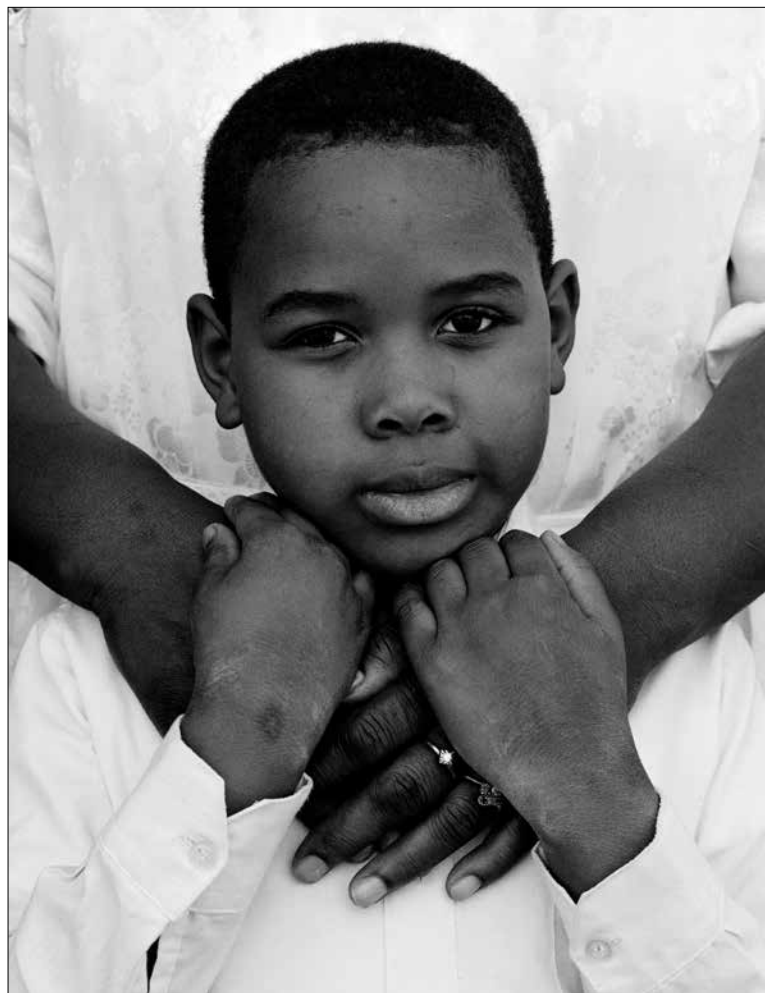


Photo by Jim Bailey

Who's Minding the Kids?

By Lynn Fisher Designed by Leigh Caruthers Prassel

Fueled by increases in reports of child abuse and neglect, often the result of incarceration, substance abuse, domestic violence and HIV/AIDS, record numbers of children are being raised by their grandmothers.

The 2000 Census revealed that across the United States, nearly 4.5 million children were living in homes headed by 2.4 million grandparents. Half the time, the grandparents, most frequently the grandmothers, are the primary caregivers. While most of these children are white, 13.2 percent are African American, a disproportionately high number when compared to other racial groups.

Many African American grandmothers, already facing difficult choices and challenges, are encountering a new struggle

as well: raising children within the rules of the child welfare system. While the grandmothers have physical custody, the state has legal custody.

"The restrictive and challenging nature of caregiving under the watchful eye of the state is often in opposition to the fluid, informal, and flexible traditions that are culturally representative of black families," says Yvette Murphy, assistant professor in the Fulbright College School of Social Work.

In a study she conducted on the child welfare system in North Carolina, Murphy found that grandmothers often felt the system imposed boundaries on how they should function as families and expected them to step in and raise their grandchildren with little or no support, financially or emotionally.

Further complicating the issue is the historical role of black women as caregivers for "other folk's children." Murphy learned that researchers hold very different opinions about whether caring for others' children is a strength for the African American community and African American women, given that images of the mammy, the matriarch and the welfare mother are stereotypes typically used to oppress black women.

In contrast, some African American women experience motherhood as empowering, teaching them the importance of valuing and respecting themselves.

Murphy found that such oppositions often give rise to a conflicting range of meanings and responses about motherhood among African American women and their families.

While conducting her research, Murphy discovered that African American grandmothers — torn between the needs of their children and their grandchildren, without the services and financial support offered to foster parents and told how they may and may not discipline the children — often responded by becoming advocates for change within the child welfare system.

"Given a history of stereotyping and oppression, black women are typically committed to social activism aimed at making things better for their children, sisters, families and communities," Murphy says.

Many grandmothers find the restrictions and rules of the child welfare system intrusive.

"It was like I lived — me and my husband lived in a goldfish bowl," said one grandmother. "We had a guardian (court advocate). Social workers would come to our house at 8 or 9 o'clock in the morning, you know, just to see what was going on because it was (a case involving) abuse and neglect."

Among the stresses the grandmothers experience is the pressure to adopt. To ensure that children in state custody find permanent homes quickly, Congress passed the Adoption and Safe Families Act in 1997. As a result, grandmothers are faced with the decision to adopt their grandchildren or risk having them adopted by someone outside of the family.

The decision to adopt can place grandmothers in a difficult dilemma: many feel they are being forced to choose between their children and their grandchildren.

One grandmother, voicing sentiments shared by many, told Murphy, "I don't plan to adopt them, because she's still their mom. And we have a good relationship, you know, their mom and the children. And I'm not going to take that away from her. Because one day she might get herself together, and she can have those children back."

A major source of frustration for many of the grandmothers was the difference in support provided to them as opposed to

foster parents. They complained of unfairness and injustice when they compared the lower levels of financial, psychological and emotional support offered to them.

Murphy found that such perceived differences in levels of support led many to feel taken for granted, devalued and sometimes treated as though they were invisible. Some felt that the welfare system should be grateful that the grandmothers are saving the system money.

"If we hadn't had those grandkids," said one grandmother, "then they would be paying somebody else more money. For a grandchild to go into a (foster or group) home, that's at least \$1,000 a month or more."

Several described the value of offering genuine love to a grandchild kept within the family as "priceless."

Murphy found that many child welfare practitioners were aware that raising children within the system was hard for grandmothers trying to balance the needs of their children with those of their grandchildren. They also acknowledged that child welfare policies altered the traditional practices of the grandmothers.

The workers conceded that while they didn't fully understand the cultural values of these grandmothers,

they appreciated the sacrifices many were willing to make for their grandchildren.

One worker, an African American and a grandmother as well, observed "That's the way it has always been with African American grandparents. We do whatever is needed to make it work. If we have to make a pod on the chair or on the floor, if we are going to have to put three in a bed, then we're going to do that."

Murphy plans to conduct a similar study in Arkansas. She hopes her research will offer insights for new training, policies, and education programs within the child welfare system, and, most importantly, she says, "give voice to these gentle yet strong women." ■



Photo by Russell Colleen

Yvette Murphy is an assistant professor in the Fulbright College School of Social Work. She has studied the challenges that African American grandmothers face while trying to raise their grandchildren.

**The Night Breeze Off The Ocean: Poems**

Michael Heffernan

*Eastern Washington
University Press*

University of Arkansas professor Michael Heffernan's seventh book of poetry, "The Night Breeze Off the Ocean," is a collection of Heffernan's poetry going back to at least 1991. While it includes some poems published in his previous books, most of the material is new.

The title conjures up an image of a wave-swept beach under a starry night sky, but a beach is not the stuff of this poetry. Heffernan said he read an account of a friend's trip to Africa, and felt a sense of being in another place, breathing the air there.

The thematic aspect of the book articulates itself by way of how the poems seem to fit together and echo each other.

Heffernan's poetry has appeared in American Poetry Review, Boulevard, Crazyhorse, Gettysburg Review, Iowa Review, Poetry, Southern Review, Shenandoah, The Kenyon Review, TriQuarterly, Hotel Amerika and other journals. He has also published short stories. His fourth book of poetry, "Love's Answer," won the Iowa Poetry Prize in 1993. He has published two books in Ireland with Salmon Poetry, most recently "Another Part of the Island" (1999). He has won three fellowship grants from the National Endowment for the Arts. ■

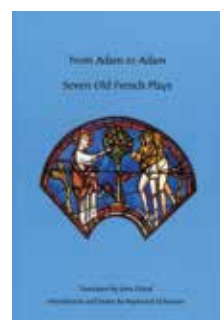
**Stone Songs on the Trail of Tears
The Journey of an Installation**Pat Musick, Jerry Carr,
Bill Woodiel*University of Arkansas Press*

In 2002, artist Pat Musick, her husband Jerry Carr and historian Bill Woodiel began a journey to commemorate a portion of the Trail of Tears, the forced migration path that the Cherokee and other American Indian tribes walked, leaving their homelands for the unknown.

Musick and her crew created an art installation called "Stone Songs on the Trail of Tears." The book follows the trio's journey, with photographs, poetry, maps, journal entries and introductory essays on art and history.

The installation, featuring five yokes that combine oak, wood, steel and native Ozark sandstone, traveled to 22 stops along the Benge Route of the Trail of Tears, across northern Arkansas. Musick and her crew moved the installation to each spot, sometimes using wagon ruts or other physical remains to guide their way. They spent time in each area, meeting locals, photographing and moving on.

Donald Harington, author and University of Arkansas professor of fine arts, contributed an introductory essay, as did Woodiel and Jack Baker, president of the National Trail of Tears Association. The book features 70 color photos, each accompanied by a poem written by Musick in the voice of a young Cherokee mother making the journey. ■

**From Adam to Adam: Seven Old French Plays**Translated by John DuVal
Introduction and notes by
Raymond Eichmann*Pegasus Press*

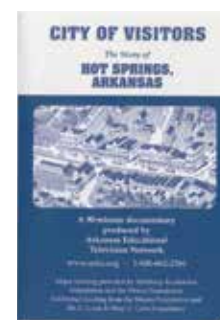
John DuVal, director of the literary translation program, and Raymond Eichmann, professor of French at the University of Arkansas, have teamed up to produce a collection of seven important 12th and 14th century dramatic masterpieces from different genres. These plays represent some of the few manuscripts of dramatic presentation that have remained preserved since Medieval times.

The plays range from religious themes, such as "The Play of St. Nicholas" by Jean Bodel to the farcical "Greenwood Follies" by Adam de la Halle. Other plays include "The Boy and the Blind Man," a farcical tale of a lecherous, hypocritical blind man and a boy who constructs illusions for him, and "The Play of Robin and Marion," a tale of social mores between the aristocratic and peasant classes.

An introduction to each play provides information on the principles of translation and on the play's background, including possible dates and locations of performances, performance practices, stage design and layout, costumes, props and music.

The translations offer a lively, lyrical look at a faraway time and culture.

This collection will be of value to students and teachers of French, comparative literature, English and drama, as well as to others. ■

**City of Visitors**

Dale Carpenter, producer

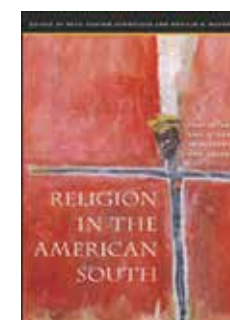
*Produced by Arkansas Education
Television Network*

Tourists seeking the healing baths in Hot Springs, Ark. have often sought other entertainment as well – much of it illegal, from gambling to prostitution and liquor. Fascinated by the evolution of this colorful city, University of Arkansas journalism professor Dale Carpenter produced "City of Visitors," a documentary that follows the political history of Hot Springs as well as the difficult choices the townspeople make as they struggle to reconcile moral issues with the increasing wealth such entertainment produces.

Carpenter discovered that the town's citizens were constantly dealing with the question of how openly the illegal forms of entertainment should be allowed to operate.

Over the years, the city hosted illustrious and notorious visitors alike from around the world, such as Al Capone, Wyatt Earp, President Herbert Hoover, Bonnie and Clyde, Babe Ruth and Helen Keller. Gangsters from New York, Chicago and Detroit would flee to Hot Springs for sanctuary, protected from prosecution by the local authorities.

Federal laws passed in the 1960s forced the state to close illegal gambling for good. The state legislature passed a bill to legalize gambling, but Gov. Winthrop Rockefeller vetoed it. Since becoming legal in 1933, Oaklawn racetrack is the only remaining outlet for gambling in Hot Springs. ■

**Religion in the American South: Protestants
and Others in History and Culture**Edited by Beth Barton Schweiger
and Donald G. Mathews*UNC Press*

University of Arkansas history professor Beth Barton Schweiger and Donald G. Mathews of the University of North Carolina at Chapel Hill have edited a book on religion in the American South from the beginning of the 18th century to the Civil Rights movement of the 1960s. "Religion in the American South: Protestants and Others in History and Culture" incorporates essays from young scholars with different perspectives.

The essays address subjects often not considered in discussions of the Bible Belt, including Muslim slaves, biracial revivals, southeastern Indians, Confederate soldiers, North Carolina Jews, white Pentecostals and black Memphis émigrés to Detroit.

This collection pushes the scholarly conversation on Southern religion into new territory. It demonstrates the importance of religion in the South to American religious history and to the history of the nation as a whole. It also shows that religion embraced and interpreted every corner of society – from the nightclub to the lynching tree; from the church sanctuary to the kitchen hearth. The collection examines 18th-century religious history, conversion narratives, the cultural power of prayer, the importance of women in exploiting religious contexts in innovative ways, and the interracialism of Southern religious history. ■

**Lofty Dogmas: Poets on Poetics**Edited by Deborah Brown, Annie
Finch, Maxine Kumin*University of Arkansas Press*

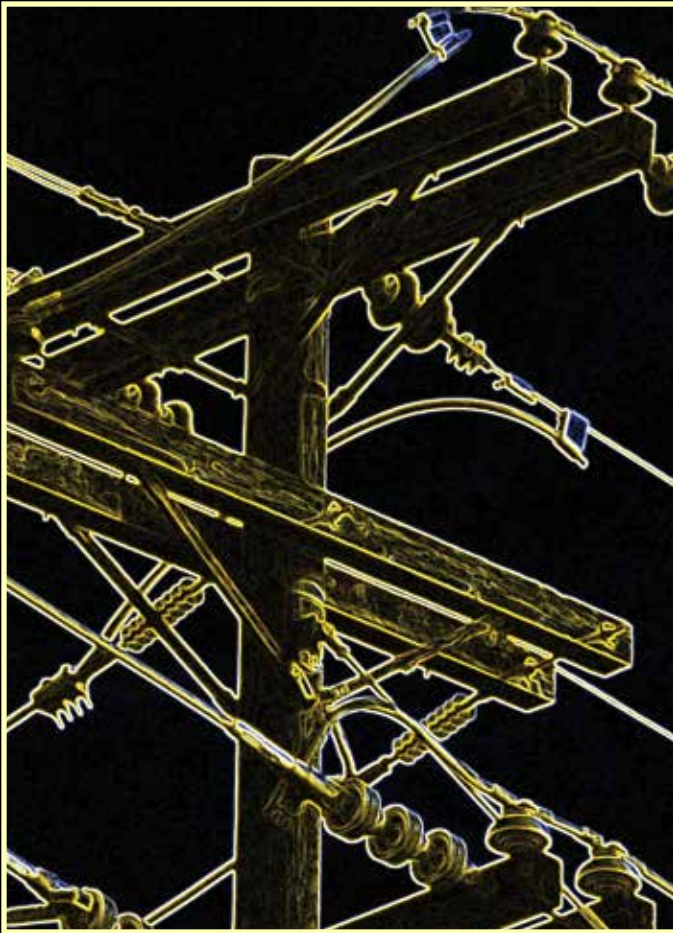
Three noted poets – Deborah Brown, Annie Finch and Maxine Kumin – have joined forces to compile a body of work that reflects the views of poets on poetry. The 102 selections span eras, ethnicities and esthetics, reaching back in time to the Greeks and Romans and drawing on Chaucer, Shakespeare, Sidney and Milton, then on to Shelley, Keats Coleridge and Poe, then Hopkins, Yeats, Eliot, Rilke and Pound, concluding with contemporary poets such as Hall, Clifton, Mackey, Kunitz and Rukeyser.

The book is divided into three sections: "Musing," concerning issues of inspiration; "Making," involving issues of craft, from diction and meter to persona and voice; and "Mapping," the role of poetry and the poet in everyday life.

Notes at the beginning of each selection provide background information on the poet and commentary on the significance of the selection. The book also includes an appendix with a listing of essays arranged according to specific topics.

Brown is an author and English professor at the University of New Hampshire. Finch is an author and professor at the University of Southern Maine. Kumin is a Pulitzer Prize-winning poet who lives in New Hampshire. ■





WHAT CAUSES POWER OUTAGES?

Alan Mantooth, professor of electrical engineering, replies:

Short-duration power interruptions or transients, commonly referred to as power sags, surges, brown-outs or blips, can be caused by numerous things – an accident such as a squirrel getting fried on a power transformer or a car hitting a utility pole, or an abnormally high power demand on a subsystem.

On a hot and humid summer day after a thunderstorm has rolled through and downed a power line or two, other power lines experience a higher than normal load, which can lead to higher voltage drops on lines and voltage sags in local areas such as buildings and neighborhoods.

When subsystems, distribution legs or substations on the larger grid, operate at close to capacity, they are much more susceptible to loading effects, such as large industrial users switching equipment on and off. These events can also cause voltage and current “spikes” in the power grid that might lead to short outages. These outages are typically short-lived and appear as short-term power interruptions.

The electric power grid has protection devices, much like your home has circuit breakers, to open, or interrupt, the circuit when the current exceeds a certain point. The power grid is a highly capable engineering system, but it has limits. As regional growth occurs, power companies continually redesign systems to manage the needs of residents and businesses. ■

WHAT IS THE DIFFERENCE BETWEEN THE INTERNET AND THE WORLD WIDE WEB?

Craig W. Thompson, professor and Acxiom Database Chair in Engineering, computer science and computer engineering, replies:

People use the terms Internet and World Wide Web interchangeably, but they are not synonymous. The Internet is an underlying network that enables higher level applications like the Web, e-mail, instant messaging, file transfers and search engines to operate.

The Internet is a decentralized global network connecting millions of computers and allowing them to share information. Each computer separately decides what services to make available to the global Internet community. Home users often connect to the Internet via Internet Service Providers (ISPs) using phone lines, DSL or cable. The Internet is a collection of standards, including Transmission Control Protocol/Internet Protocol (TCP/IP) a set of rules that define how to reliably send packets of information between computers and how to route these packets through the network to their final destination.

The World Wide Web is a collection of hypertext files available on Web servers located anywhere on the Internet that end-users can access via Web browsers like Internet Explorer or Mozilla. In the 1980s, Tim Berners-Lee, working at CERN, the European particle physics lab in Geneva, developed protocols for sharing information and a browser that used these standards. Key standards include a way to specify links (Uniform Resource Locators or URLs, e.g. <http://www.uark.edu>), a document format (Hypertext Transfer Markup Language or HTML) that provides simple ways to add headers, bold, and other markup to a document, and a way to exchange documents (Hypertext Transfer Protocol or HTTP). Another standard incorporated into browsers is Multiple Internet Mail Extensions (MIME), a method of identifying file types by their standard extensions, so that browsers could display many kinds of information.

Thus, the Internet enables network technology but it has grown because of applications like the Web, e-mail and others that make it easy for people to share information. ■