Spring 2003

Spring 2003

PERSPECTIVES

SPRING 2003

RESEARCH AND CREATIVE ACTIVITIES

SOUTHERN ILLINOIS UNIVERSITY CARBONDALE

Lush Life

Getting to Know Earth's Family Tree

ALSO: KOSOVO ON FILM ✠ SEEING THE LIGHT ✠ NANOTECH IN CARBON ✠ THE POET'S WORLD

One of the greatest pleasures of serving as a university's chief advocate for research is seeing research, scholarship, and creative work in the arts flourish on campus. Research grants awarded to SIUC totaled more than $28 million in the fiscal year ending June 30, 2002—a 10 percent increase over FY01. Grants for all types of activities, including training and public service, totaled more than $61 million, a 13 percent increase.

That growth speaks to the quality and dedication of our faculty and students. The work they do, with or without grant support, to expand knowledge and human expression is important and diverse.

In the sciences, for example, it's hard to imagine two more disparate research areas than the evolution of land plants (see cover story) and the physics of carbon nanotubes (see p. 18). Yet both of these projects have implications for the environment and human health.

Other work speaks to other human needs. For example, a new book by Elisabeth Reichert (p. 4) gives U.S. social workers and social work students a much more extensive grounding in the principles, history, and guiding documents of human rights than they have had previously.

Poet Allison Joseph, whose fourth book has just come out, is gaining nationwide attention as a writer of rare insight into society, family, and self (p. 22).

Undergraduate Brenda McCollum is already starting to make a name for herself with her luminous watercolor paintings (p. 10).

And a documentary produced by graduate student James Saldana about Albanian refugees from Kosovo (p. 2) was named a finalist in the 2002 Angelus Awards Student Film Festival, which recognizes stellar films that explore the human condition.

Those are just a few examples of the kaleidoscope of activities taking place outside the classroom at SIUC. Each issue of *Perspectives* seeks to give our readers a glimpse of that diversity. We hope you enjoy the view.

John A. Koropchak
Vice Chancellor for Research and Graduate Dean

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For information about the research program at SIUC, visit www.siu.edu/~ovcr, or contact John A. Koropchak, Vice Chancellor for Research and Graduate Dean, (618) 453-4551, koropcha@siu.edu, or Prudence M. Rice, Acting Director, Office of Research Development and Administration (ORDA), (618) 453-4531, pmrice@siu.edu.

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PERSPECTIVES

SPRING 2003 | RESEARCH AND CREATIVE ACTIVITIES

SOUTHERN ILLINOIS UNIVERSITY CARBONDALE

CONTENTS

KUDOS FOR TEAM KOSOVO

▲ **A child stands in the ruins of a residential area in Kosovo.** ***Photo by Todd John.***

Two young Americans stood on the deck of a ferryboat on the Adriatic Sea and watched as lights appeared in the distance, revealing the coastline of Albania. It was dusk, and in the fading light of a spring day, the young men were able to make out the hulls of abandoned ships half-submerged in the harbor of the port city of Duress. Military helicopters hovered overhead.

The year was 1999 and ethnic cleansing was underway in the neighboring Yugoslavian province of Kosovo. The Americans were film student James Saldana and photographer Jeff Norman, who had traveled from their Chicago homes to film the exodus of Albanian refugees from Serb-controlled Kosovo. The refugees were flooding Albanian border towns in a desperate attempt to escape the carnage that had left thousands dead.

As the ferry docked in Duress, a groundswell of noise overpowered the sound of the helicopters overhead. Saldana and Norman felt a flash of fear as they realized that the noise was thousands of people yelling. Refugees, packed like sardines behind a series of fences, were shouting with a desperate fury that was focused on the ferryboat entering the harbor.

The crowds of refugees wanted one thing, and they all wanted it at once: to get out.

If the ferryboat captain had not taken their passports from them, the two students might have decided to turn back. As it was, they made certain that their video cameras were well-hidden beneath their coats, then followed their fellow passengers off the ramp and into Albania.

"There was an air of danger there, and we definitely felt it," says Saldana. He and Norman shot most of their film and conducted interviews in a refugee camp on the outskirts of Kukes, a town on the border of Albania and Kosovo. The first family they met introduced them to families who spoke English, and soon the filmmakers were recording wrenching stories of the refugees' experiences.

The two remained in Kukes for several weeks, shooting as much footage as they could before returning to Chicago. Their budget was so tiny that they often relied upon the refugees for food. Saldana was arrested twice, once by Albanian soldiers when he was filming on a military landing strip, and again by Arab soldiers at a neighboring refugee camp. He managed to talk his way out of both situations.

Over the next two years, Saldana graduated from the University of Illinois at Chicago and raised funds for his film. He eventually recruited a volunteer crew of six other students, christened the crew "Team Kosovo," and headed back to Kosovo on a shoestring budget in 2000 during the NATO occupation. Team Kosovo returned once more, traveling to Macedonia in 2001 with the 82nd Airborne division.

Several SIUC students worked on post-production on the film with Saldana, by then a graduate student in SIUC's Interactive Multimedia program. Early in 2002, he and fellow SIUC graduate student Richard Carsley, the film's co-producer, submitted "Our Road to Kosovo" to the Angelus Awards competition, the most prestigious student film festival in the United States.

It was named a finalist in the documentary category, beating out dozens of other entries, many from better-heeled film programs. "Our Road to Kosovo" had its world premiere at the Directors Guild Theater in Hollywood last November.

"Albania is not a tame place," says Saldana, "but I wanted the story of the refugees to be told."

For more information, see the film's web site at http://idc.siu.edu.

—Claire O'Brien (excerpted with permission from a Southern Illinoisan article)

FLOOD OF DATA

Nicholas Pinter, an SIUC geologist who's a respected expert on Midwestern floods, will spend the upcoming months applying lessons learned on the Mississippi and Missouri Rivers to increasingly flood-prone rivers in Europe.

"We hope to look at a number of European rivers—the Rhine, Oder, Elbe, Danube, Tisza, Meuse, and perhaps others," Pinter explains. "All of these rivers experienced record-breaking floods last summer and the Rhine was in major flood mode again in January.

"We will examine rivers, climate, and other data in hopes of discovering why floods on many rivers worldwide appear to be larger and more frequent than in the past—and determine if humans are contributing to this worsening flooding."

A prestigious $96,000 grant from the John D. and Catherine T. MacArthur Foundation partially supports Pinter's work.

He is teaming up on the project with German colleague Rienk van der Ploeg, an internationally recognized professor of soil science who teaches at the University of Hanover in Germany. The two will use the German university as their research base for initial data collections. Rounding out the science team are graduate students from the United States, Germany, and Hungary.

Assistance with much of the ground-floor research—on the Mississippi and Missouri Rivers—came from then-master's student Russell Thomas, says Pinter. Thomas has since completed his geology degree and now works for Schlumberger Information Solutions in Houston.

In 2001, Pinter, Thomas, and U.S. Geological Survey hydrologist Joseph Wlosinski concluded that floods had grown worse along the middle Mississippi River (the stretch from St. Louis to Cairo, Ill.) and that engineering structures to improve navigation, such as wing dams, were largely to blame.

The team reached that finding after analyzing historical data on the middle Mississippi River dating back, in some cases, to the mid-1800s. This project was featured in the Fall 2001 issue of *Perspectives;* see www.siu.edu/~perspect/01_fall/flooding.html.

Pinter's research on European rivers is part of a MacArthur Foundation initiative on technological change and global security and sustainability. The grant runs through the end of May 2004.

Pinter also won a Friedrich Wilhelm Bessel Research Award from the Alexander von Humboldt Foundation (Germany), only of only 10 given to scholars worldwide, to support his work.

For more information: Dr. Nicholas Pinter, Dept. of Geology, npinter@geo.siu.edu.

—Paula Davenport

Working with a sharp knife and a pair of scissors, geology major Joseph Peterson carefully cuts into a large plaster-covered package sitting on a table in the basement of Parkinson Laboratory.

Inside the wrapping is the humerus bone of a triceratops, a plant-eating dinosaur that roamed the earth 67 million years ago. The bone was found in eastern Montana's Hell Creek formation.

"The triceratops was one of the last dinosaurs to face extinction," says Peterson, pulling away the protective covering, "so this really represents the final days of the dinosaurs."

Peterson and other geology students will spend many months cleaning and preserving the specimen before sending it to its owner: the Burpee Museum of Natural History in Rockford, Ill.

SIUC's connection with the museum is geology alumnus Michael Henderson, Burpee's curator of earth sciences. In a research partnership that Peterson helped set up, the museum plans to send similar projects to SIUC's Geology Department while it is engaged in restoring a rare, complete dinosaur skeleton found in summer 2002.

"We expect to be involved with cleaning, preserving, and casting many specimens like this one in the months to come," says geology research project specialist Harvey Henson Jr.

The work will give students the chance to learn from some of the top dinosaur researchers in the country, he says.

—Rod Sievers

ADVOCATE FOR CHANGE

Social work education in the United States needs to go global, says Elisabeth Reichert. Not geographically, but philosophically.

A foundation of social work in the United States has been the principle of social justice. As a past practitioner who specialized in sexual abuse cases, Reichert has a veteran's experience with such issues and their connection to social justice.

But although the concept is part of the National Association of Social Workers Code of Ethics, it is nebulous, argues the associate professor of social work. "Different people use the term in different ways," she says. And some emphasize social justice for the group, which may not necessarily constitute social justice for the individual.

While attending the 1995 United Nations Conference on Women's Rights in Beijing, China, Reichert found herself wondering why social workers in the United States didn't place more emphasis on human rights. After all, the International Federation of Social Workers references human rights rather than social justice in its code of ethics. Various international documents have codified these rights, which she felt offered broader and more-explicit guidance for social work practice than the concept of social justice does.

Researching the subject, Reichert found that little had been published in the United States about human rights from a social work perspective. So she took the matter in hand by writing her own text, geared to students and practitioners. *Social Work and Human Rights: A Foundation for Policy and Practice* was published by Columbia University Press in March 2003.

"Within the United States, social workers have been reluctant to integrate human rights into the profession," Reichert says. She thinks that's because in this country, human rights often are seen solely as political and civil rights.

But the term also encompasses social and economic rights, which many nations stress more than the United States does. For example, access to health care is a human right that's legally recognized by many countries but not by the United States.

In a culturally diverse world, the path to human rights has been a bumpy road. The modern cornerstone of human rights is the Universal Declaration of Human Rights, issued in 1948 by the newly formed United Nations. Even in the aftermath of the Holocaust, however, the nations weren't without disagreement in drafting a human rights statement.

For instance, Soviet bloc countries thought economic rights ought to be more highly ranked than political rights; some Islamic countries felt that a declaration of worldwide human rights would endanger their cultural practice of arranged marriages; and South Africa, where apartheid reigned, wouldn't agree to anything that promised equality for all.

In 1966, after 18 years of debate, the United Nations passed the International Covenant on Civil and Political Rights and the International Covenant on Economic, Social, and Cultural Rights to put some enforcement muscle behind the Universal Declaration. The United States has ratified the former, but not the latter.

Aspects of human rights continue to be debated globally. "There are still arguments," says Reichert. "A poor or less economically developed country in Africa may say it is more important to have food than democracy. Human rights is always full of tensions."

Nonetheless, she says, understanding the full spectrum of human rights can help social workers be more effective advocates for change.

"Part of our professional identity is working to bring about changes in policy," she says. "That's why human rights is a natural for our field."

There is a growing movement in the United States to more closely tie social work practice and research to human rights principles, she adds: "I'm not the only one writing about this topic. Social work is moving into more of a rights-based than a needs-based profession."

A focus on human rights gives social workers "a strong basis for empowering their clients," she says, "but on a bigger scale, it

gives people in different countries a common language for tackling major issues, such as child abuse."

As a framework for analyzing cases and aiding clients, human rights principles can help social workers make decisions when confronted with the gray areas and ethical dilemmas so common in this profession, Reichert believes.

Take the thorny problem of cultural relativism: what happens when human rights principles clash with a client's cultural or religious tradition? For example, should a couple be allowed to refuse vaccinations for their child due to their religious beliefs? Or should an immigrant woman be advised to leave a verbally abusive spouse—in violation of her culture's taboos—even if she has no financial resources for herself and her children?

Social workers must be as sensitive as possible to their clients' cultural background, Reichert says. Indeed, understanding how cultural norms differ is part of the profession's code of ethics.

But where there are clashes, social workers must keep human rights principles front and center, she asserts.

"Social workers have the responsibility to challenge individual and social relations that create and maintain oppression," she writes in her book.

After all, she adds, "Helping those in need, those who are vulnerable and oppressed, is what social work is all about."

For more information: Dr. Elisabeth Reichert, School of Social Work, (618) 453-2243 or reichert@siu.edu.

—Bonnie Marx; Marilyn Davis

GOOD FAT FOR FISH FLESH

Farm-raised fish could become healthier both in the pond and on the plate if research under way at SIUC pans out.

Based at SIUC's Fisheries and Illinois Aquaculture Center, the project will focus on developing a cost-effective means of boosting the levels of omega-3 fatty acids in farm-raised fish.

Various health researchers have found that people who eat fish with high levels of these polyunsaturated fats have less trouble with everything from heart disease and strokes to depression.

"We're interested in omega-3 long-chain fatty acids from the human nutritional standpoint, but we're also interested in them from the standpoint of the fish," says Christopher Kohler, director of the aquaculture center.

"These components are beneficial to them in strengthening their immune systems, making them healthier. They're also better able to survive the cold of winter. A healthier fish is best for all of us, whether we raise it or eat it."

Kohler and his research team will concentrate on feed and feeding strategies because fish truly are what they eat, he says.

"If we feed them higher levels of these components, they will take on higher levels in their edible flesh—within certain ranges. Catfish, for example, are not very fatty fish. Hybrid striped bass, on the other hand, should be very amenable to this kind of manipulation. It's a good fish for our region, and we're going to make it better through the feed."

▲ **Striped bass.** ***Photo courtesy SIUC Fisheries and Illinois Aquaculture Center.***

A three-year, $600,000 grant from the National Science Foundation's Partnerships for Innovation program is funding the work. The program fosters cooperation between educational institutions, private industry, and government agencies to transform knowledge into business ventures that can strengthen the economy.

SIUC's partners are the Archer Daniels Midland Co. Animal Health and Nutrition division, the Illinois Fish Farmers Cooperative, and the Illinois Department of Commerce and Economic Opportunity.

ADM's Animal Health and Nutrition division will contribute its trademarked animal feed supplements for use in the feed trials, and some of its scientists may help with analysis, Kohler says. The Illinois Fish Farmers Cooperative will help round up members to take part in on-the-farm tests and also will process and store the fish involved.

When it comes time to promote the technology, the Department of Commerce and Economic Opportunity and SIUC's Office of Economic and Regional Development will swing into action.

"A major purpose of these partnerships is to encourage commercialization," Kohler says.

"This project holds many advantages for all the partners involved," says John Koropchak, SIUC vice chancellor for research and graduate dean.

"Not only will it lead to increased nutritional benefits for consumers, but there are opportunities for economic development and job growth throughout the region and state."

For more information: Dr. Christopher Kohler, SIUC Fisheries Center, (618) 536-7761 or ckohler@siu.edu.

—K. C. Jaehnig

A big record in animal longevity was set by a very small resident of the SIUC Vivarium in January. A dwarf mouse died one week shy of his fifth birthday, surpassing all known records for mouse longevity among either wild or laboratory-raised animals.

"In terms of an animal that normally lives two to two-and-a-half, occasionally three years, this guy was way out there," says Andrzej Bartke, an SIUC physiologist and expert on aging who has been studying longevity in dwarf mice.

"It would be like a human living to be 180 to 200."

The mouse came from a line of research mice that produce growth hormone but do not respond to it. Bartke has used them to study the impact of growth hormone resistance on male reproductive function.

"We think one of the reasons these mice live so long is because they have low levels of insulin and glucose," he says.

The world's oldest mouse bore a close resemblance to the dwarf mouse, bred to be resistant to growth hormone, that's shown at right in the photo below. The mouse on the left is of normal size.

The tiny mouse weighed only 8 grams when he died—about as much as eight paper clips. His body is being studied by researchers at the University of Texas in San Antonio.

—K. C. Jaehnig

Photo courtesy Michael Bonkowski, geriatrics researcher at the SIU School of Medicine, Springfield.

HEAR, HEAR!

An expert on brain processes related to hearing has won SIUC's 2003 Outstanding Scholar award.

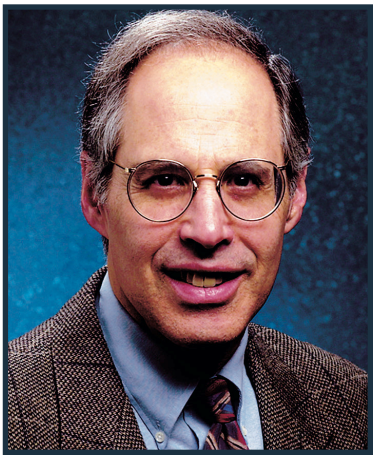
Neuropharmacologist Donald Caspary, a faculty member and assistant dean at the SIU School of Medicine in Springfield, first gained attention for his landmark studies on the effects of particular chemicals that transmit information to nerve cells in the mid-brain and inner ear.

According to Richard Salvi, director of the Center for Hearing and Wellness at the University of Buffalo, Caspary's work "has dominated this particular area of research."

Caspary also played a role in refining a drug-delivery technique used in pharmacological studies. The improvements enabled scientists to undertake intensive tests previously impossible to run. Caspary trained neuroscientists from across the country in the use of this new technology.

Caspary's current research focuses on how the brain's ability to process auditory signals changes with age. He hopes that this knowledge might lead to the development of drugs that could treat age-related hearing loss. He also is working on problems related to tinnitus—that annoying "ringing in the ears" sensation.

Caspary has had funding for his work from the National Institutes of Health since 1973, a remarkable record that is shared by few other scientists. He also has received the NIH's Claude Pepper Award.



▲ Neuropharmacologist Donald Caspary was named SIUC's Outstanding Scholar for 2003.

His findings regularly appear in such publications as the *Journal of Neuroscience,* the *Journal of Neurophysiology, Neuroscience,* and the *Journal of Comparative Neurology.*

Colleagues in his field describe Caspary as "a scientist's scientist," a "leading researcher," and a "pioneer."

"Donald Caspary was there years in advance of the crest, defining the problems, framing their solution, proposing clear hypotheses that could be tested explicitly," said University of California at Berkeley professor Jeffery A. Winer, a world-class neuroanatomist, in a letter supporting Caspary's nomination for the scholar award.

"He has the ability to imagine what the rest of us could not even think." ✠

—K. C. Jaehnig

BREAKING NEW GROUND

Grit and determination helped tens of thousands of African-Americans overcome discrimination in decades past to find work in Southern Illinois' once-teeming coalfields.

"Working in the Seams: An Initial Photographic View into the African-American Coal Culture in Southern Illinois," a recent exhibit created by five SIUC graduate students and their professor, pays homage to these oft-overlooked laborers of color.

The exhibit, consisting of 25 large prints, opened at the African American Museum of Southern Illinois last November and is now traveling to venues across the nation.

Lee Buchsbaum, a master's student in photography, is the project's chief architect. Other contributing photographers are Joshua Sanseri, a master's student in art and design; Deidre Hughes, a doctoral student in history; Eric Robinson and Robert Booker, unclassified graduate students; and associate professor Daniel Overturf, who teaches documentary photography.

Since spring 2002, they've been taking portraits of African-American coal miners and their descendants in Southern Illinois mining settlements to help capture a previously little-known piece of regional history.

Funding for the ongoing project comes from the Illinois Humanities Council and the SIUC Coal Research Center. Additional support is being provided by the United Mine Workers of America's District No. 12.

Sanseri's photos for the project won the Grand Prize in the university/college portfolio category of the Photographic Imaging Education Association's 2003 contest. Those prints will be part of a four-continent touring show sponsored by PIEA and the Photographic Marketing Association International.

For more information: Daniel Overturf, Dept. of Cinema and Photography, (618) 453-1487 or dvo0201@siu.edu.

—Paula Davenport

▲ **One of the first African-American top bosses at a Southern Illinois coal company, Charles "Peaches" Gude, poses at his former workplace, Old Ben Coal Co. Mine #27. *Photo courtesy Lee Buchsbaum.***

Poet Rodney Jones, professor of English and a linchpin of SIUC's creative writing program, has won the 2003 Harper Lee Award, given annually by the Alabama Writers' Forum to a living, nationally recognized Alabama writer of creative nonfiction, drama, fiction, memoirs, or poetry.

Jones was born and raised in Alabama, earned his bachelor's degree from the University of Alabama at Tuscaloosa, and had his first book of poems, *The Story They Told Us of Light,* published by the University of Alabama Press in 1980.

His seventh book, *Kingdom of the Instant,* was published last year by Houghton Mifflin. One of the poems from that volume, "Ten Sighs from a Sabbatical," has been chosen for the 2003 edition of *The Best American Poetry,* the nation's top poetry annual.

CATTLE CURE?

Grazing cows that miscarry or don't conceive at all because of a toxic fungus common in pasture grass could benefit from an experimental drug originally developed in Europe for human use, say two SIUC researchers.

"Levels of progesterone (a hormone that helps maintain pregnancy) were reduced when the animals in our study were fed the toxic fescue," says Karen Jones, an animal biotechnologist in the College of Agricultural Sciences.

"This has been observed before by other researchers, but what was different in our study was that the experimental drug brought those levels back up to almost normal."

The drug, domperidone, has previously been tested in horses but not in other livestock.

Co-researcher Sheryl King, an animal physiologist, says the study showed that domperidone also kept weight gain at normal levels in animals feeding on fungus-infected fescue. Without the drug, animals fed the toxic fescue grew less than animals fed non-toxic fescue did.

Fescue rules in most livestock pastures throughout the United States. This hardy, nutritious grass resists pests and drought and grows back easily, even when closely cropped by grazing animals, because of a fungus in its stems and blades that helps it thrive.

But what's good for the grass is bad for the beasts. The fungus produces a toxin that throws animal reproductive systems out of whack and impairs health and growth.

"In cattle, fescue toxicosis is responsible for an $800 million loss annually," Jones says. "Any solution to this problem will translate directly into money in the producers' pockets."

A two-year, $59,000 grant from Illinois' Council on Food and Agricultural Research (C-FAR) funded the study. While the results were dramatic, the researchers caution that some questions about the use of domperidone remain unanswered.

"We have to figure out the best working dose, and we also have to figure out a more convenient means of delivery (than daily injections)," King says.

The drug also must win FDA approval for animal use before it becomes commercially available.

For more information: Dr. Sheryl King, Dept. of Animal Science, (618) 453-1771 or sking@siu.edu.

—K. C. Jaehnig

RACE: MISSISSIPPI

A video created by SIUC anthropology professor Jane Adams and her husband, photographer D. Gorton, for Adams' class on America's diverse cultures has been recognized by Apple Computer Inc. in its web site's "Profiles in Success."

The 23-minute video, "Race: Mississippi," focuses on several Southerners who played very different roles in their state's struggle for civil rights some 40 years ago.

"The resulting scenes are at times eerie, anger-inducing, and inspirational, but always compelling," the profile says.

The video features civil rights activist Alyene Quin, Chinese-American grocers Hoover and Freeda Lee, Jewish businessman Stanley Sherman, white private school founder Betty Furniss, and former Citizens Council leader Horace Harned, to this day an unabashed white supremacist.

Getting those interviews on film was important, Adams says, in order to capture gestures and expressions that add to the significance of what the interviewees have to say.

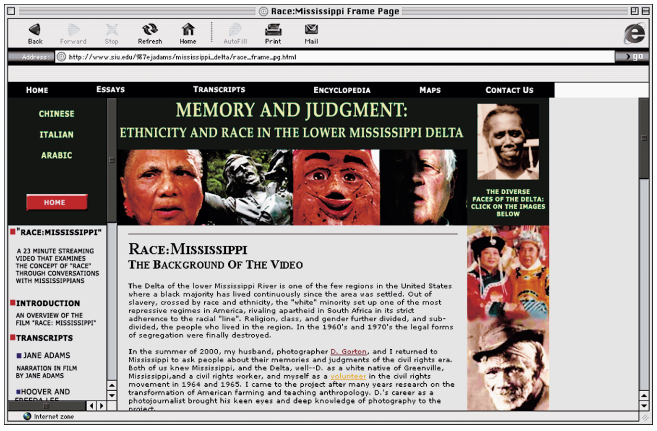
The video is part of a larger "Mississippi Project" that aims to portray the civil rights movement of the 1960s from all perspectives. When complete, it will contain a series of digital video interviews, still photos, home movies, and documents both private and public, all archived and linked on the Internet.

The web site is "a way to allow everybody, not just serious scholars, to have access to original source material," Adams says.

The web site, called "Memory and Judgment: Ethnicity and Race in the Lower Mississippi Delta," is at www.siu.edu/~jadams/mississippi_delta/mj_frame.html. The site includes a link to the video.

To read the Apple profile, go to www.apple.com/education/profiles/carbondale/index.html.

—K. C. Jaehnig



MORE MAYA

For the second year running, archaeological research on ancient Maya groups in Central America has netted SIUC's Outstanding Dissertation award.

The prize for 2002 went to Keith Prufer, an anthropologist who illuminated the importance of caves to the religious practices of pre-Hispanic Maya who lived in the rugged mountains of what is now southern Belize. In 1997 he won a graduate research fellowship from the National Science Foundation to support his investigations.

"Unlike researchers who preceded him, Dr. Prufer recognized the cosmological importance of caves to the Maya," wrote SIUC anthropologist Don Rice, a Maya expert who supervised Prufer's dissertation. By documenting ritual materials and their placement in the caves, Prufer gained an understanding of the roles and activities of Maya shamans.

In a previous *Perspectives* article, Prufer explained that in the Maya religion, "caves were seen as entrances to the underworld where extremely important gods lived and...where dead souls go. The ancient Maya ventured deep into subterranean chambers to construct altars, burn incense, and inter their dead."

Artifacts that he found in the dark depths included incense burners, rosewood stools, jade beads, and prayer benches.

Prufer focused on 53 caves in the Ek Xux Valley and Muklebal Tzul region of the Maya Mountains, little-known sites that are hard to get to and even more difficult to equip as research camps. Colleagues who supported Prufer's nomination for the dissertation prize described his five seasons of fieldwork as arduous and risky.

"Many of the cave sites Keith [studied] were ones which he was the first to explore and map, requiring long backpacking treks away from creature comforts, and mapping and excavating by lamplight," wrote SIUC anthropologist Prudence M. Rice, internationally known for her own work in Maya archaeology.

"Clearly, 'surface archaeology'—the spectacular pyramids and temples of Classic Maya civilization—has had more appeal and greater ease of excavation," as compared to the dangers of cave exploration.

Perhaps because of that interest in pyramids and temples, archaeologists have focused more on the Maya's kings and high priests and less on their medicine men. Yet it was the shaman and his rituals that played a major role in the daily lives of pre-industrial farmers and their communities.

As Don Rice notes, rituals and ritual leaders are important to maintaining group cohesion and to helping people adapt to their natural and social environments.

Prufer has already published a book and several scholarly articles and has presented numerous papers at national conferences. He is now a visiting instructor at Auburn University.

—K. C. Jaehnig

SIUC's Department of Finance ranks in the top 5.6 percent of all university finance departments worldwide for research productivity, according to a study published by the journal *Financial Management* in its winter 2002–03 issue. The study ranks the SIUC department, part of the College of Business and Administration, 52nd out of 923 institutions. The ranking is based on publications in a set of 16 core finance journals from 1990 through 2001.

CHANNELING

Philip Jensik, who earned his M.S. in physiology last year, has received the SIU Alumni Association's Outstanding Thesis award for 2002.

His work focused on proteins in cell membranes that act as channels regulating the flow of important chemicals in the body. Understanding how such proteins work has a bearing on heart disease, kidney disease, and other disorders.

To function properly in changing circumstances (for instance, exertion or injury), the body must control the movement of ions, such as potassium, sodium, and calcium ions, into and out of its cells. Without the right controls, body systems can get dangerously out of balance, causing irregular heart rhythm or other problems.

What governs the flow of ions? Various chemicals cause receptor proteins in the cell membrane—channels—to open. This creates a route for ions to enter the cell.

Physiology professor Thomas Cox, Jensik's mentor, studies a kind of channel important in controlling the flow of potassium and sodium ions in the heart, kidney tubules, and blood vessels. These channels, found in vertebrates as diverse as fish and humans, are regulated by a basic cell chemical called ATP.

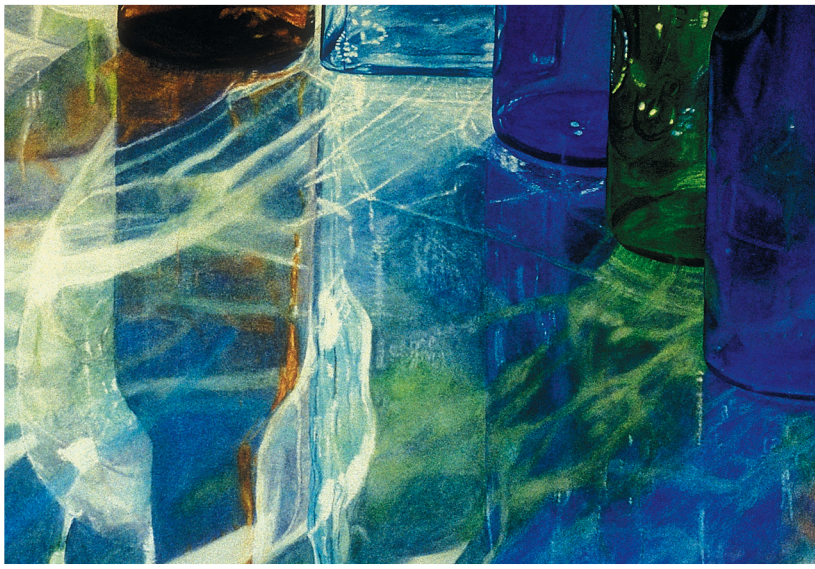
For his master's research, Jensik discovered and studied an unusual, closely related kind of channel in the skin of frog tadpoles that's thought to play a role in sensory processes.

Jensik cloned the DNA that directs cells to make the channel protein. From the DNA sequence, he determined the protein's amino acid composition. By studying the behavior of the channel in the cell membrane, he discovered (among other things) that repeated exposure to ATP causes enzymes to break down the protein, eventually destroying the channel.

Jensik's findings about the structure and properties of this channel, which have been published in the *American Journal of Physiology,* will help other scientists better understand how these body regulators function and differ across species.

—Marilyn Davis

SEEING THE LIGHT



Brenda McCollum's watercolors transform the ordinary.

by Marilyn Davis

It was a wrong turn on the interstate that steered artist Brenda McCollum onto the right path in her work. And it was a class with nationally known painter Ed Shay, an SIUC professor of art, that converted her to the medium she needed: watercolor.

When McCollum graduated from Rend Lake Community College (Ill.) and transferred to SIUC as an art major, she was painting mostly with acrylics. Watercolor initially frustrated her; she was used to layering and glazing paint in ways that would produce a muddy mess in watercolors.

But the class with Shay gave her the practice she needed to master this medium—specifically, transparent watercolor, which doesn't use white paint. "If you use watercolor [paint] without white, the light will go through it and bounce back off the paper. That gives the painting more of a translucent appearance," she explains.

McCollum had always wanted to capture light in her work, and always been fascinated by the kaleidoscopic patterns light made as it shone through glass. During a road trip with local artist and mentor Sarah Capps, the two missed their exit from I-57, got off, and "wandered into this little town with three little antique stores," says McCollum.

"Really they were junk stores. I saw old bottles and jars in these dark stores, and something about the way the light was coming through them drew my attention."

She photographed them—the start of a fruitful preoccupation with collecting, photographing, and painting glass containers. Light "has the ability to take ordinary vessels and transform them into the extraordinary," she writes in her artist's statement.

McCollum began doing luminous but straightforward watercolor paintings of bottles and jars on shelves or tables. One of her first glass acquisitions was an old, cobalt-blue Vicks Salve bottle, and her first bottle painting showed only blue bottles. Since then, she always includes at least one blue bottle in each painting.

"Blue represents the spirit in Christianity, and blue is my favorite color," she says. "That blue bottle ties everything together."

One of the earlier paintings in the bottle series, titled "Chemistry 101," won Best of Show last year in the national 9th Annual Juried Art Exhibit at the Jasper (Ind.) Arts Center. But only after a critique in Shay's class did McCollum realize that light itself, not the bottles, was the real subject of her recent work.

"I had always wanted to paint light, and I was finally doing it and didn't realize it," she says.

With Shay's endorsement, she applied for and won an SIUC Undergraduate Research/Creativity Award of $1,500 to create a set of paintings exploring light as a metaphor for spirituality. The shifting play of light symbolizes the way the human spirit changes and evolves, she says.

Not surprisingly, her favorite glass containers are those with personality—old jars with pearlescent patinas from the contents they once held, or old bottles that have been unearthed and bear metal encrustations and scars.

"They're not pristine anymore," she says.

Shay had been encouraging McCollum to produce bigger-scale works, and the SIUC grant, among other things, allowed her to buy special rolls of extra-large, high-grade watercolor paper.

"But I think the biggest thing this grant has done for me is that my style has evolved," she says. The works she's produced for the grant project are more colorful, close-up, and abstract-looking than her earlier paintings in the bottle series. Parts of them resemble melted stained glass.

They've expanded her artistic range while still satisfying her love of realism. How so? As she notes, they're a faithful rendition of the abstract planes and swirls of light cast by the colored bottles.

Each painting takes McCollum two to three months to complete. She starts by studying the light on different bottle setups and in photographs, collaging elements she's interested in. She does pencil sketches and then, when she's satisfied, a full-size pencil drawing on the watercolor paper. Only then does she paint.

Although McCollum's recent works have grown more vibrant, she still prefers her paintings to "make quiet statements," enabling viewers to draw from the work "something that's personal to them."

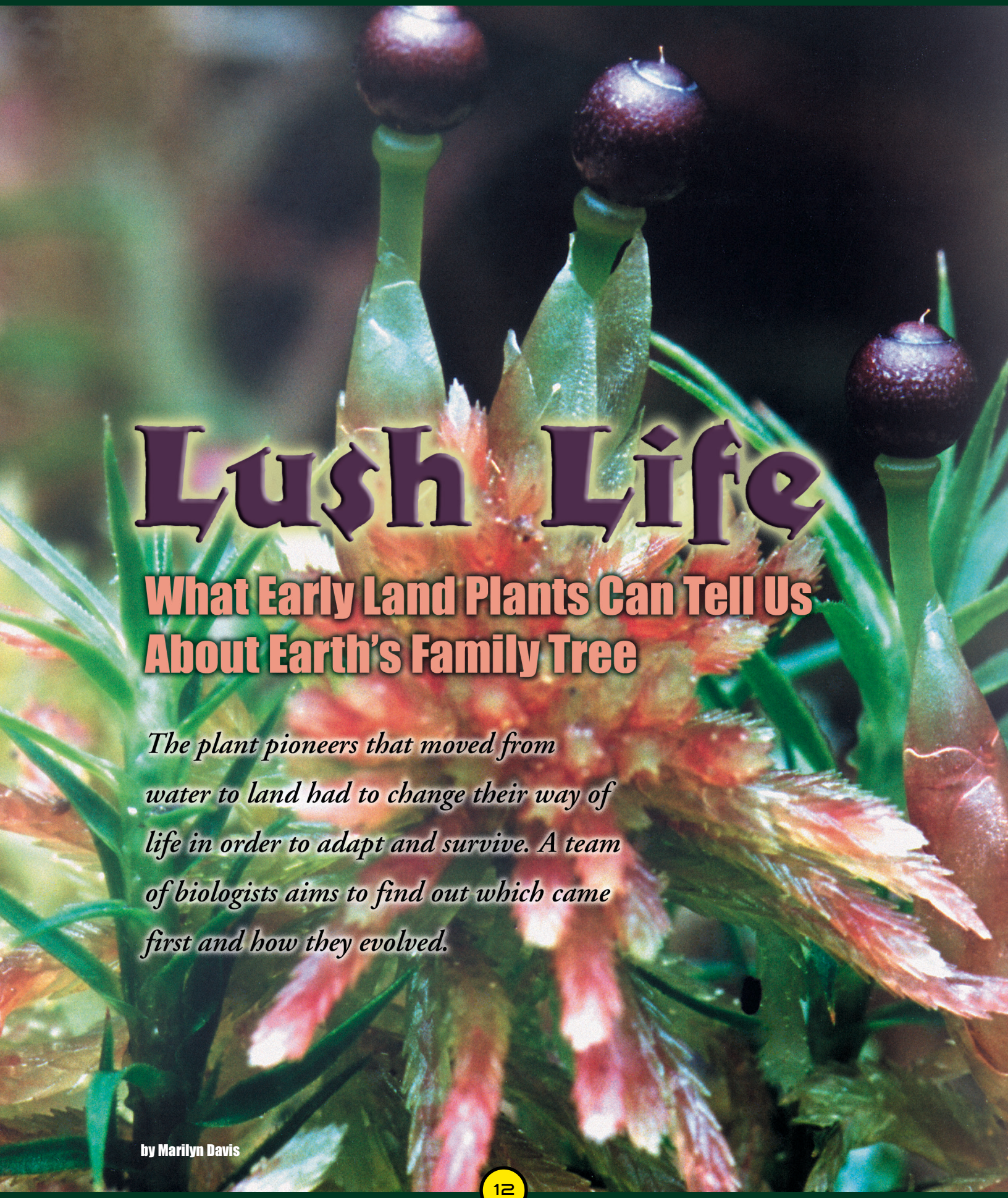
One of her favorite artists is Edward Hopper. "I love the way Hopper did light," she says. "Most people only know his oil paintings, but he did a lot of watercolors on location. They're so still and quiet."

McCollum has exhibited her work in venues in Illinois, Missouri, and Indiana, and has won awards in several competitive art shows. A member of the Illinois Artisans Program, she'll exhibit the finished series of bottle paintings sometime this year at the affiliated Southern Illinois Art Gallery in Whittington—fittingly, located right off I-57, the highway that launched her new artistic explorations.

"I don't know where my paintings will be in six months," she says, "but I can't see myself not painting glass, now that I like it so much. It'll probably be ongoing for the rest of my life." ✪

For more information, contact Brenda McCollum at (618) 438-0017 or c/o the SIUC School of Art and Design at (618) 453-4315.

◀ "Beneath the Surface" (left, 36x47″) and "Spirit Dance" (right and background, 28x36″) by Brenda McCollum. 2002.



Lush Life

What Early Land Plants Can Tell Us About Earth's Family Tree

The plant pioneers that moved from water to land had to change their way of life in order to adapt and survive. A team of biologists aims to find out which came first and how they evolved.

by Marilyn Davis

Half a billion years ago, the land on Earth was barren rock and ash. Only the water—the oceans, shallow seas, and lakes, teeming with simple aquatic plants, invertebrates, and primitive jawless fishes—held the secret of life.

Then somewhere, somehow, a brave new kind of green algae got a grip on the rocky shore. That momentous step, which may have happened in many places in various ways, made possible the world we know. We owe our existence to the land plants that evolved subsequently—to the oxygen they pump out, the nutrients they make and store, the soil they build, the animals they feed and shelter.

How did plants get that initial toehold on land, survive, and go on to diversify into the lush life we take for granted? A group of scientists dubbed "Deep Green" is dedicated to finding out.

▲ **Karen Renzaglia and Scott Schuette, a master's student in plant biology, use a transmission electron microscope to capture images of moss reproductive cells.**

"Deep," in this case, means deep in time. These biologists are fascinated with the "green" family because of its age and its central place in life on earth.

How did multicellular aquatic plants evolve? Which plants first colonized land? How are the early plant lineages related to each other? What genetic, cellular, and structural changes did they undergo?

With funding from the National Science Foundation's "Tree of Life" initiative (see sidebar p. 16), nine "Deep Green" scientists at SIUC and other institutions are tackling these questions to reconstruct in detail the family tree of the plant kingdom. The five-year, $3 million "genealogical" study is focusing on plant groups with an ancient heritage, such as algae, mosses, and ferns, where evolutionary relationships are fuzzy at best and where the most dramatic biological changes had to occur.

"If we can understand the relationship of living organisms—put together a 'big picture' of how life evolved—we can answer some important biological questions, which could influence everything from improving human health to managing the environment effectively," says SIUC plant biologist Karen Renzaglia, a member of the team.

Renzaglia, who will receive $375,000 from the NSF for her part of the research, studies cell-level changes in early land plants. "The constraints of living on land are pretty incredible," she says. "You have to figure out how to hold your body up against gravity, how to keep from drying out, how to move water and chemicals around in the body—and how to do sex out of the water!"

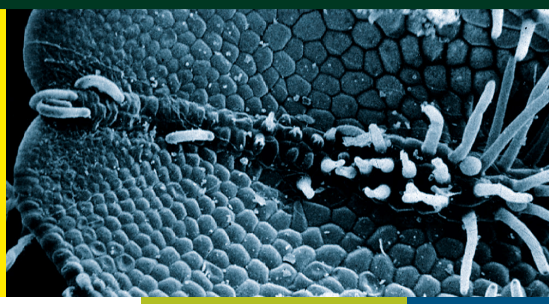
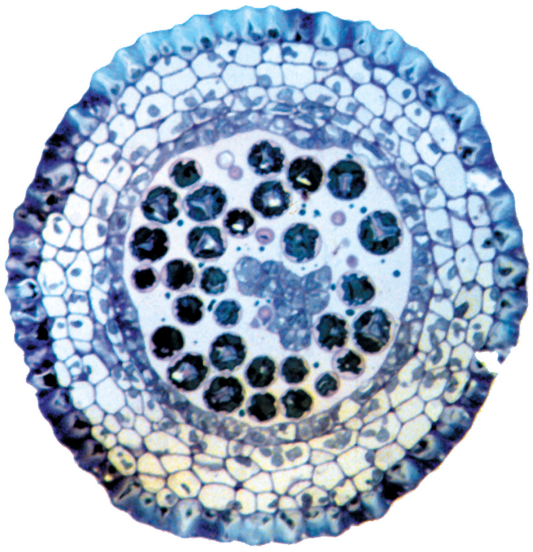
The earliest land plants to begin solving those problems are still the smallest: mosses, liverworts, and hornworts. Collectively called bryophytes, they're found on every continent but Antarctica. They hug the ground, absorbing water and nutrients directly through their cells. Skinny threads called rhizoids, precursors of root systems, anchor them to the soil.

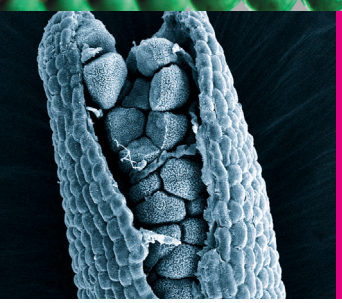
Only after plants evolved true root systems and veins to ferry around water and nutrients could they grow very big. Giant tree ferns lifted their fronds up to the sun; rush-like horsetails and club mosses developed tall spore-bearing cones. These new types of plants, collectively called pteridophytes (Greek for "fern plants"), changed Earth's landscape dramatically.

◀ **Sphagnum moss with spore-bearing capsules.** ***Photo by Alan S. Heilman.***

Bryophytes and pteridophytes may have conquered the land, but they still rely on a film of water for reproduction. In mosses






and their relatives, the plant produces sex organs containing sperm and egg cells. When the sperm are released, they "swim" to eggs on the same plant or nearby plants. Each fertilized egg sprouts a thin, short-lived stalk that bears spores along its sides or in a capsule at its tip. The spores fall to earth, where they germinate and produce new plants.

In ferns and their relatives, that sequence is reversed: The mature plant makes the spores. Turn over a fern frond and you'll see neat dots of spores bracketing the veins. When those spores fall to the soil, they each sprout a tiny plant—a mere speck on the forest floor or even underground—that exists to make egg and sperm cells. The sperm wiggle their way through water drops to fertilize nearby eggs, which then sprout new ferns.

Not until the evolution of seed-bearing plants, some millions of years later, did plant species free themselves from the need for water to get sperm and egg together. Seed plants—the trees, flowers, and grasses so familiar to us—package sperm in pollen, an ingenious solution that also enables them to reproduce at a distance.

Beyond these broad outlines, little is known for certain about early plant evolution.

"Major portions of this evolutionary tree are ambiguous," says Renzaglia. "There are so many gaps in our knowledge about the life cycles, structure, and development of early land plants. And almost nothing is known about the cellular details. These plants have evolved some fundamentally different mechanisms for [cell division and reproduction] that will give us information about evolutionary relationships."

Renzaglia studies the morphology (form and structure) and cell biology of plants. She has gained a worldwide reputation for her studies of sperm cells in bryophytes and pteridophytes.

"Nobody knew the diversity of sperm in plants before we started doing this work," she says. Similarities and differences in these cells across species tell her a lot about when different groups of plants evolved and how they are related to each other.

Renzaglia suspects that the lowly hornwort, which coats itself with a water-holding layer of slime, was the earliest land plant that still exists today. In a separate project also funded by the NSF, she and biologist Joel Duff at the University of Akron are piecing together the family tree of the world's 150 or so kinds of hornworts.

So little is known about hornworts, she says, that "it's hard to know what defines a species or genus." Her morphological work, plus Duff's data on gene sequences and proteins that occur in these plants, are overturning current classification schemes.

"We never predicted the relationships we're coming up with," she says, "but they make sense in terms of which is the oldest hornwort and how the group developed."

Why sort out the hornworts? Why try to

▲ **A plethora of life forms. (Unless otherwise noted, all photographs are by Karen Renzaglia and courtesy of Dan Nickrent; see Land Plants Online at www.science.siu.edu/landplants/). Clockwise from upper left:**
•The hornwort *Phaeoceros carolinianus,* with its spore-bearing "horns."
• *Tmesipteris,* an early land plant related to ferns (photo by Lytton Musselman).
•A scanning electron micrograph (SEM) of the underside of a liverwort showing the threadlike rhizoids (at right) that anchor the plant to the soil.
•Spores of the fern *Ceratopteris richardii.*
•A pore in the tissue of the hornwort *Phaeoceros laevis.*
•The horsetail *Equisetum telmateia* (photo by Dan Nickrent).
•Spores of the liverwort *Podomitrium phyllanthus.*
•The hair cap moss, *Polytrichum.*
•An SEM of the sperm cell of the horsetail *Equisetum hyemale.*
•The moss *Hypnum curvifolium.*
•The liverwort *Pellia epiphylla.*
•A cross-section of the spore capsule of the moss *Takakia ceratophylla* .
•An SEM of a partially opened spore stalk of the hornwort *Dendroceros crispata.*
•The fern *Stromatopteris monoliformis* with clusters of spore cases (photo by Lytton Musselman).

figure out the evolutionary pathways of the earliest land plants at all?

On an economic level, this information will help efforts in, for example, drug prospecting. If you identify one hornwort that produces a pharmaceutically useful compound, you'll want to zero in on that species' closest relatives so that you can analyze them for similar compounds.

On the environmental level, efforts to conserve biodiversity and save species will rely on knowledge about genetic relationships. Because we can't save everything, we should try to preserve the greatest genetic diversity, Renzaglia says. Species that are very distinctive genetically, with no close relatives, should take higher priority than species with abundant close relatives.

On a broader level, determining the history of early land plants will tell biologists more about how life forms function and have developed (see sidebar p. 16).

The "Deep Green" team has chosen for in-depth analysis some 50 species of plants that they believe represent major lineages among green algae, bryophytes, and pteridophytes. The team's leader, Charles O'Kelly of the Bigelow Laboratory for Ocean Sciences (Maine), is studying the morphology of the algae species. Renzaglia and her students are doing the same for the others.

To understand all the developmental stages of these plants, they're scrutinizing spores and spore capsules, egg and sperm

"As buds give rise to fresh growth, and these, if vigorous, branch out and overtop on all sides many a feebler branch, so by generation I believe it has been with the great Tree of Life, which fills with its dead and broken branches the crust of the earth, and covers the surface with its ever branching and beautiful ramifications."

—Charles Darwin, *The Origin of Species,* 1859

Reconstructing the evolutionary history of early land plants is just one part of a massive project on biodiversity. The National Science Foundation (NSF) has awarded some $17 million to seven research teams as the beginning of an effort to put together a complete "Tree of Life"—a map of the evolutionary history of all Earth's species, past and present.

Besides plants, the teams are studying such organisms as bacteria, fungi, parasitic roundworms, and birds. Each team is expected to develop methods for processing the resulting genetic and morphological information that other scientists can use to map out other branches of the evolutionary tree.

This "megascience" project grew out of concern over gaps in knowledge about the world's living species, particularly with regard to the growing numbers of extinctions. Only 60,000 to 70,000 species have been studied in any detail, and scientists estimate that the 1.75 million species they know something about represent only 10 percent of those now living. Their belief that many of these species will disappear in the decades ahead makes completing the project urgent.

"We want to catalog biodiversity before it's gone," says Karen Renzaglia, a plant biologist at SIUC who's working on the project.

The tree will be "a picture of historical relationships that explains all similarities and differences among plants, animals, and microorganisms," the NSF says. Among other benefits, a fuller understanding of the relationships between organisms could lead to new drugs and agricultural products, improved ability to track and combat emerging diseases, and better information for conservation scientists, including ways to deal with ecosystem-damaging invasive species.

—K. C. Jaehnig

cells, embryos, and mature plants. They're documenting dozens of characteristics, photographing specimens, comparing and compiling details previously reported about the species in the scientific literature, and archiving everything they find.

It's a huge amount of data. Take spores, for example. Renzaglia's team is recording, among other information, their shape and color, their "ornamentation" (whorls and ridges), their internal structure and development, and what types of molecules, such as proteins and sugars, are stored inside.

Using a scanning electron microscope, which bounces electrons off the surface of a sample, they're looking at plant structures such as stomata (pores) and sperm cells enlarged some 4,000 to 7,000 times—big enough to study the whip-like tails called flagella that enable the sperm to swim to their destination. Using a transmission electron microscope, which shoots electrons through a thin section of tissue, they're viewing the inner workings of cell nuclei and chloroplasts (the cell bodies that carry out photosynthesis). This work is being done under the aegis of SIUC's IMAGE facility.

Two tiny bryophyte species whose microanatomy differs considerably can look virtually identical to the naked eye. Conversely, one species can vary considerably in its outward appearance depending on environmental conditions. So cellular features will be key to learning how these early plants evolved.

For example, some hornworts have big chloroplasts that look identical to those in green algae, Renzaglia and Duff have found, while other hornworts have smaller chloroplasts but more of them. The latter species are farther away, evolutionarily, from the algae/hornwort split.

If this work sounds esoteric, consider that most advances in knowledge start out that way—and that life forms have surprising connections.

As an undergraduate in Renzaglia's lab, Kelly Wood studied plant sperm exposed to a mutation-causing chemical that damaged their flagella. As a result, these cells had trouble swimming. Fast forward: Wood went on to medical school, where she learned about human repro-

ductive and respiratory cells with damaged cilia (hairs that move the cells themselves or surrounding material). She discovered that these cilia had the same kinds of damage as the plant flagella, which are structurally similar. Medical researchers now have a new experimental model that may shed light on the nature of the human disorder.

Intriguing information also will come from genetic studies of early land plants. Other team members are analyzing DNA from the same plant specimens that Renzaglia and O'Kelly are working with. Among other things, they are creating "reference libraries" of thousands of chromosome snippets from each specimen for cross-species comparison. The more genes that two organisms have in common, the more likely it is that they fall on the same branch or twig of the evolutionary tree.

"If we understand these gene sequences [from early plants], it will help tell us how genomes change over time," Renzaglia says.

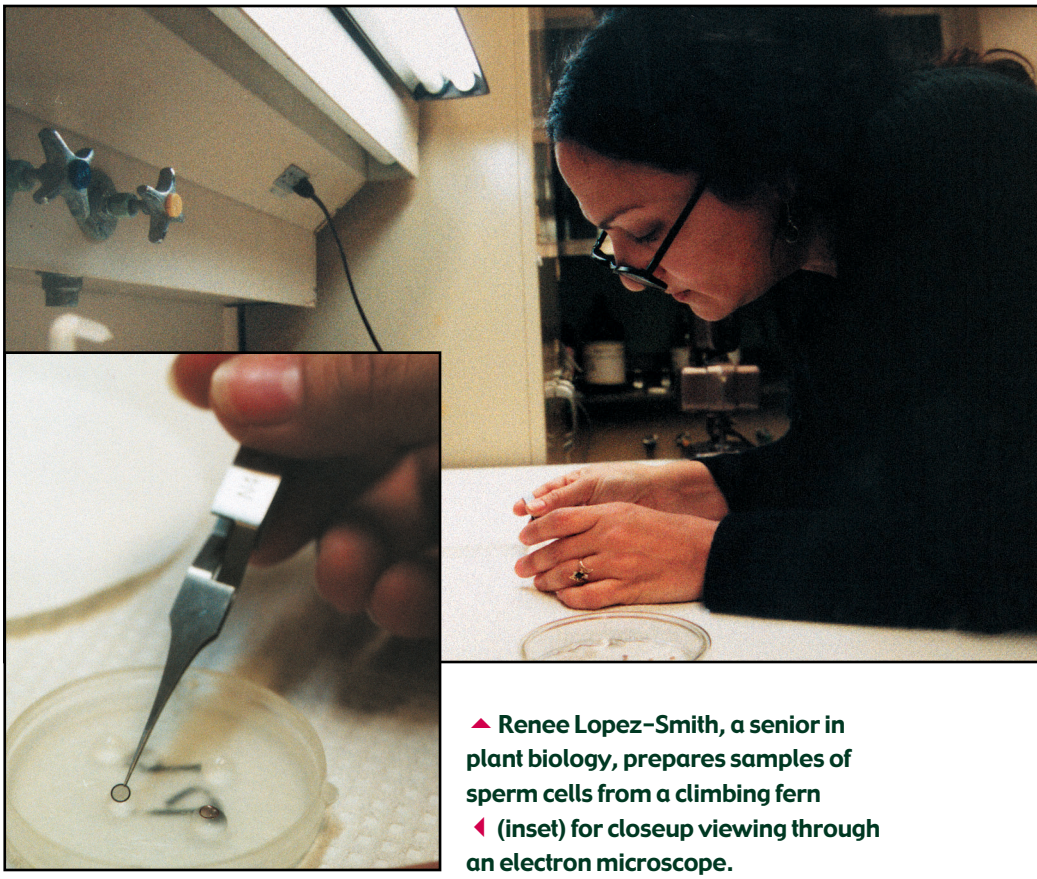
The genetic analyses will generate gigabyte after gigabyte of valuable data to be combined with the morphological data. Both are needed.

"Genes don't tell you what the plant looks like or how it functions," Renzaglia says. "And without information on morphology, you won't know what structural changes have taken place during evolution." Gene studies will help morphologists focus their efforts, and vice versa.

Although scientists ultimately will tease out the function of many genes, particularly those that are shared by many species, such analysis is time-consuming, and it can't be done for every gene in every kind of organism.

The fact that many species and even entire lineages have gone extinct over millions of years also complicates genetic analysis.

"It's possible that all of the early hornworts died off except for one branch, which persisted unchanged for a long time and then underwent recent speciation," Renzaglia speculates by way of example. "Then the group would be old, but much of the genetic diversity would be recent. In colonizing land, probably thousands of successful species died off. It's frustrating—we only have bits and pieces [of evidence]."



▲ **Renee Lopez-Smith, a senior in plant biology, prepares samples of sperm cells from a climbing fern ◀ (inset) for closeup viewing through an electron microscope.**

Why not just study fossil plants?

"You can't get DNA out of fossils," Renzaglia notes. "You can't see development; you can't see sperm. You can't, in many cases, see cellular details. And we don't have a good fossil record of the bryophytes—they're small and fragile."

Pinning down the details of plant evolution will take a grand synthesis of fossil, genetic, and morphological evidence. And that poses the team's biggest technical challenge: how to wade through all that data.

The team will develop new methods of organizing, combining, and analyzing diverse data sets to draw conclusions about evolutionary history. Their Holy Grail is an analytical model that can be applied to determine the evolutionary relationships of many kinds of organisms.

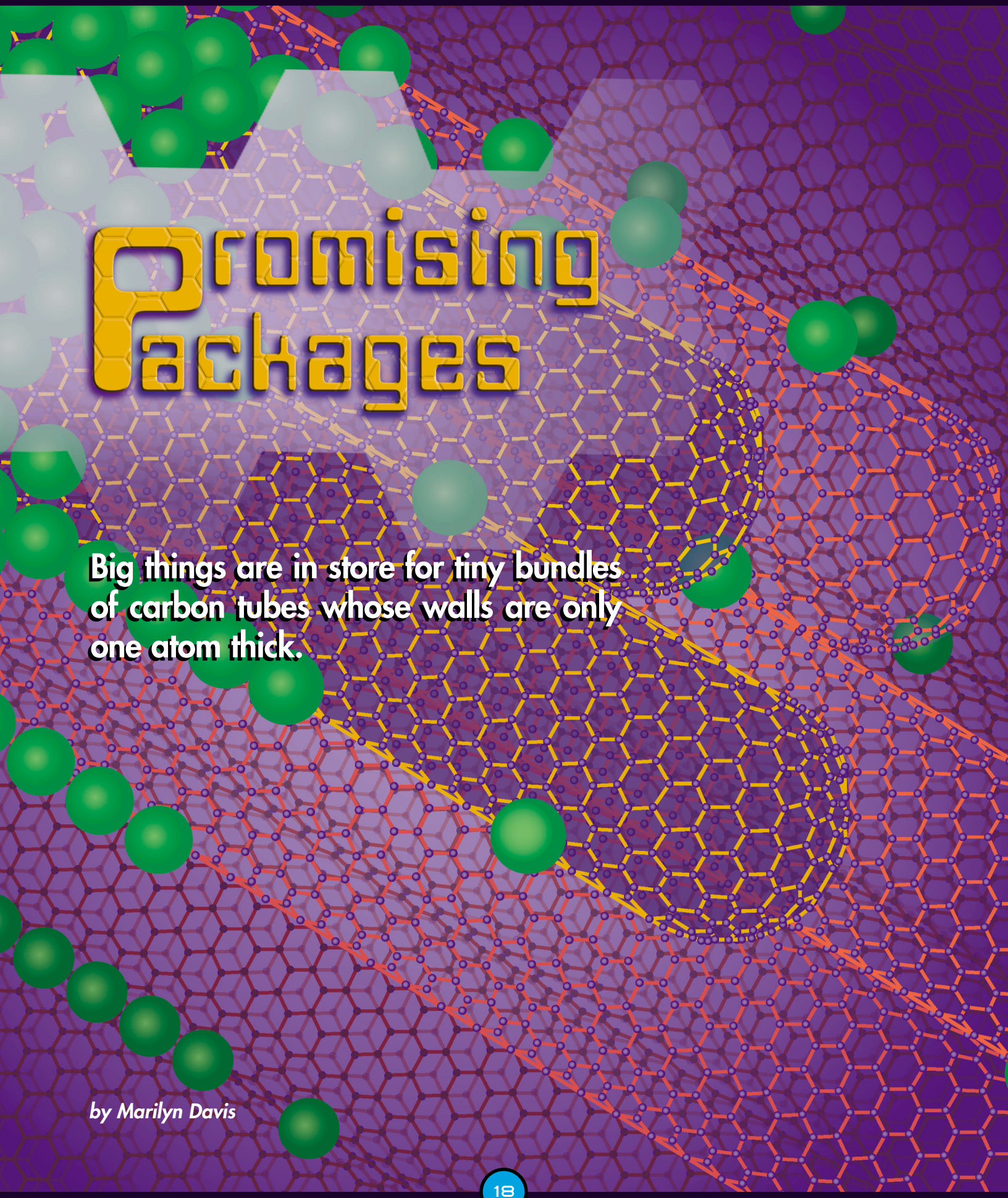
Besides Renzaglia and O'Kelly, scientists at the University of California - Berkeley, the University of Washington, Yale University, Utah State University, and Lawrence Berkeley National Laboratory are working on the project.

Renzaglia is passionate about this work.

"It has the potential to uncover all kinds of new information," she says. "There's biodiversity at every level of life, including the cellular level. This research has opened up a world nobody's known about.

"We don't know what we're going to discover, but we know it will rewrite the textbooks." ✪

For more information, contact Dr. Karen Renzaglia, Dept. of Plant Biology, at (618) 453-3229 or renzaglia@plant.siu.edu, or see the Land Plants Online web site at www.science.siu.edu/landplants/.



Promising Packages

Big things are in store for tiny bundles of carbon tubes whose walls are only one atom thick.

by Marilyn Davis

Atomic-scale carbon tubes are among the smallest solid structures in nature. But researchers hope that they may transform industry in a major way—by storing fuel for hydrogen-powered vehicles and serving as filters to purify gases, among other uses.

Physicist Aldo Migone is one of the scientists exploring the properties of these nanotubes, as they're called. Nanoscale materials are measured in nanometers, which is getting down to the molecular or even atomic level (a nanometer is one-millionth of a millimeter). The type of nanotube Migone studies is basically a one-atom-thick layer of graphite rolled into a seamless, hollow tube. A dome of carbon atoms plugs the tube at each end, like a medicine capsule.

These tubes can be hundreds or thousands of nanometers long, but they are almost inconceivably skinny: 1.4 nanometers in diameter, or just a few atoms' width across. And they usually occur not singly, but in bundles—typically up to 200 nanotubes together, like a bundle of pipes.

Despite the nanotubes' small size, scientists can measure what happens to matter interacting with them. The fact that each tube is a single layer of atoms forming a closed structure gives these materials interesting properties.

"No tool allows you to slice anything one atom thick," says Migone, professor and chair of physics at SIUC. "So there's strong interest in these from a fundamental standpoint—you can study behavior that is difficult or impossible to observe in any other system.

◀ An artist's rendering of a bundle of several carbon nanotubes shows the hexagonal arrangement of the carbon atoms and the closed ends of these tiny structures, which cannot be seen very clearly even with an electron microscope. Nanotubes may someday be used as an efficient way to store gases such as hydrogen. Here, the green spheres represent gas atoms in the process of adsorbing to the tubes. ***Illustration by Steve Mueller, IMAGE.***

▲ Master's student Vaiva Krungleviciute adjusts a temperature controller used in gas adsorption experiments with carbon nanotubes.

"There's also strong interest from a practical standpoint, because one can envision situations in which nanotubes can help revolutionize different areas of current technology."

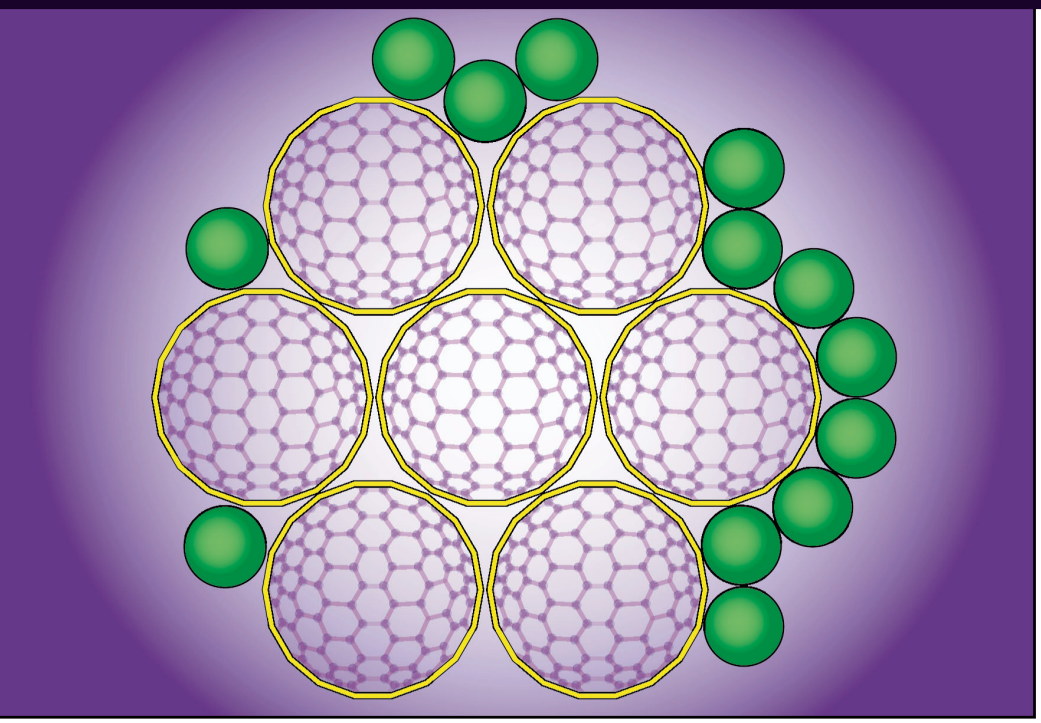
Nanotubes were discovered in 1991 by a Japanese researcher, Sumio Iijima. He was producing a newly discovered type of carbon—soccer-ball-shaped molecules called fullerenes—by arcing electricity between two graphite electrodes. The resulting soot contains a certain amount of fullerenes. But when Iijima took a look through a powerful electron microscope, he found that some of the soot was in the form of something that had never been seen before: nanotubes.

The tubes that Iijima discovered had multiple walls, or several layers. "They're like Russian dolls—capsules within capsules," Migone says. By 1993, however, researchers found that if they added certain metals to the graphite electrodes, the arc discharge process would yield single-walled nanotubes, self-organized into bundles.

If nanotube bundles can eventually be produced inexpensively in bulk—and promising work elsewhere is being devoted to this goal—the potential applications are intriguing.

For example, because the atomic bonds in the nanotube walls are extremely strong, the tubes might be used to reinforce other materials. "Per unit weight, you can't get anything stronger," says Migone. Other researchers want to use them to make nano-sized electronic components.

Migone is investigating the nanotubes' ability to adsorb and desorb (capture and release) gas atoms. For practical purposes, that means their potential for storing gases such as hydrogen or neon, or for



▲ **As this head-on graphic of a small nanotube bundle shows, gas molecules (green) first settle in the grooves where two tubes abut (left), then adhere on either side of the groove in a "Mickey Mouse ears" arrangement (top), and finally form a thin film over the curved surfaces of the tubes (right).** ***Illustration by Steve Mueller, IMAGE.***

separating one type of gas from a mixture. Research Corporation (a private foundation that supports science), the Petroleum Research Fund, and the National Science Foundation have funded his work.

"If you take any material as a substrate, cool it down in a vacuum chamber, and add pure gas, some of the gas will sit on—stick to—the substrate," Migone says. In the case of carbon, this adsorption is due to electrical interaction.

"It's rather weak binding compared to chemical binding," he says. "That why cooling down the material is important." The lower the temperature, the more readily the gas atoms will stick, because they have less energy to bounce away.

Carbon nanotubes offer the possibility of storing "pretty high densities of gas without needing very complicated machinery to do it," says Migone.

Per unit mass, the thin-walled tubes offer much more surface area for gas molecules to latch onto than a flat substrate would. The physical properties of the tubes also allow the gas atoms to pack in tightly. The atoms can reach densities similar to those in a liquid form of the gas, but at more moderate temperatures and pressures than what's normally required to keep a gas like hydrogen, say, in liquid form. It's no wonder that industry hopes to exploit nanotubes for energy systems.

Migone and his students have measured the binding energies of different gases—how strong the attachment is between the tube and the gas—at various temperatures and pressures. That allows them to know under what conditions the gas atoms are bound and released, critical details if nanotubes are someday to be used in devices to store or filter gases. They've also determined how much surface area of the nanotubes is available for adsorption.

When gas atoms stick to nanotube bundles, Migone's lab has found, they first settle in the grooves formed where one tube abuts another. The atoms form a long chain (imagine a line of BBs in a narrow channel).

When the grooves in a nanotube bundle fill up, gas atoms begin adsorbing as a film on the outer walls of the tubes themselves and can build up to two layers thick.

Although scientists in the energy field had hoped that the gaps between tubes in a nanotube bundle also could store hydrogen through adsorption, one of Migone's more important findings is that this isn't possible. Although the gaps are about half a nanometer across, the action of the carbon and gas atoms' electron clouds reduces the effective opening to about .25 nanometer. Gas atoms larger than that simply won't fit inside. This rules out not only hydrogen, but most other gases as well.

Why not store hydrogen inside the tubes themselves?

That can be done, but right now it doesn't look as feasible for commercial applications, Migone says. The process of chemically or mechanically "uncapping" the tubes creates a residue clogging the opening that requires high heat and a high vacuum to remove. As a result, he has studied only closed tubes so far.

In the early and mid-1990s, Migone had been doing adsorption experiments on flat substrates such as graphite layers. When reports about single-walled carbon nanotubes started coming out, he was one of the first scientists to begin doing adsorption studies with these structures.

Undergraduate students Erica Mackie and Sarah Weber contributed a lot to that early work. Since then, several other undergraduates and five graduate students have worked on the nanotube research. One of them, Saikat Talapatra, received a prestigious doctoral fellowship in 2001 from the Link Foundation, which supports energy-related research.

"The work with hydrogen adsorption was mainly driven by him," says Migone. "He did a lot of measurements of binding energies and the surface area available for adsorption. He was especially interested in the potential applications

of nanotubes. With him, this [research] exploded." Talapatra is now doing postdoctoral research at Rensselaer Polytechnic Institute.

If nanotubes hold promise for hydrogen storage—say, for hydrogen-powered vehicles—a critical question is whether the gas can be stored at a reasonably high temperature.

"The ideal is to be able to pack atoms closely at or close to room temperature," says Migone. "Right now it's not looking like carbon nanotubes can do it at room temperature—you might have to use liquid nitrogen to cool it."

That's still an improvement on other substrates, which would require much colder temperatures, but it may not be good enough for commercial applications.

Does that mean nanotubes won't be useful for energy systems? Not at all, says Migone. Much remains to be investigated. For example, his lab has begun comparing the adsorption properties of nanotubes produced by different means.

Most of the team's work has been done with nanotubes produced by the arc discharge process described earlier. But commercial labs can now furnish nanotubes made by two other methods: a laser process and a high-temperature chemical process. As Migone explains, "These (nanotubes) could have small structural differences, or differences in the amount of impurities present, such as various metals or different forms of carbon."

Although suppliers use various processes to remove as many impurities as possible from the nanotubes they sell, the effectiveness of these methods varies. Furthermore, says Migone, "Some of the methods used to remove impurities are harsh—they punch holes in the nanotube." In these cases, lab data on the tubes' properties can be tough to interpret.

Migone expects that nanotubes made or purified with certain methods are likely to give clearer—and more desirable—adsorption results than those made with other methods. He is especially interested in what his team will find with the laser-produced nanotubes, which have "very low levels of impurities to begin with."

He is even more optimistic about what might be achieved with a composite combining carbon nanotubes with other materials. He is collaborating with Khalid Lafdi, formerly of SIUC and now at the University of Dayton, on this effort.

That joint research is very much directed to applications, Migone says. But much of his work is more fundamental: as a physicist, he likes the opportunity nanotubes give him to study material behaving as if it were one-dimensional.

Atoms of gas adsorbed on a flat substrate can be compared to balls on a billiard table, he says: they're free to move around on the surface, but not to leave that surface. In some senses, the atoms behave like matter in two dimensions.

But gas atoms adsorbed in a groove between two carbon nanotubes are constrained even more. They can switch places in the line, but they can't move up or sideways. In effect, says Migone, "They behave like matter in one dimension."

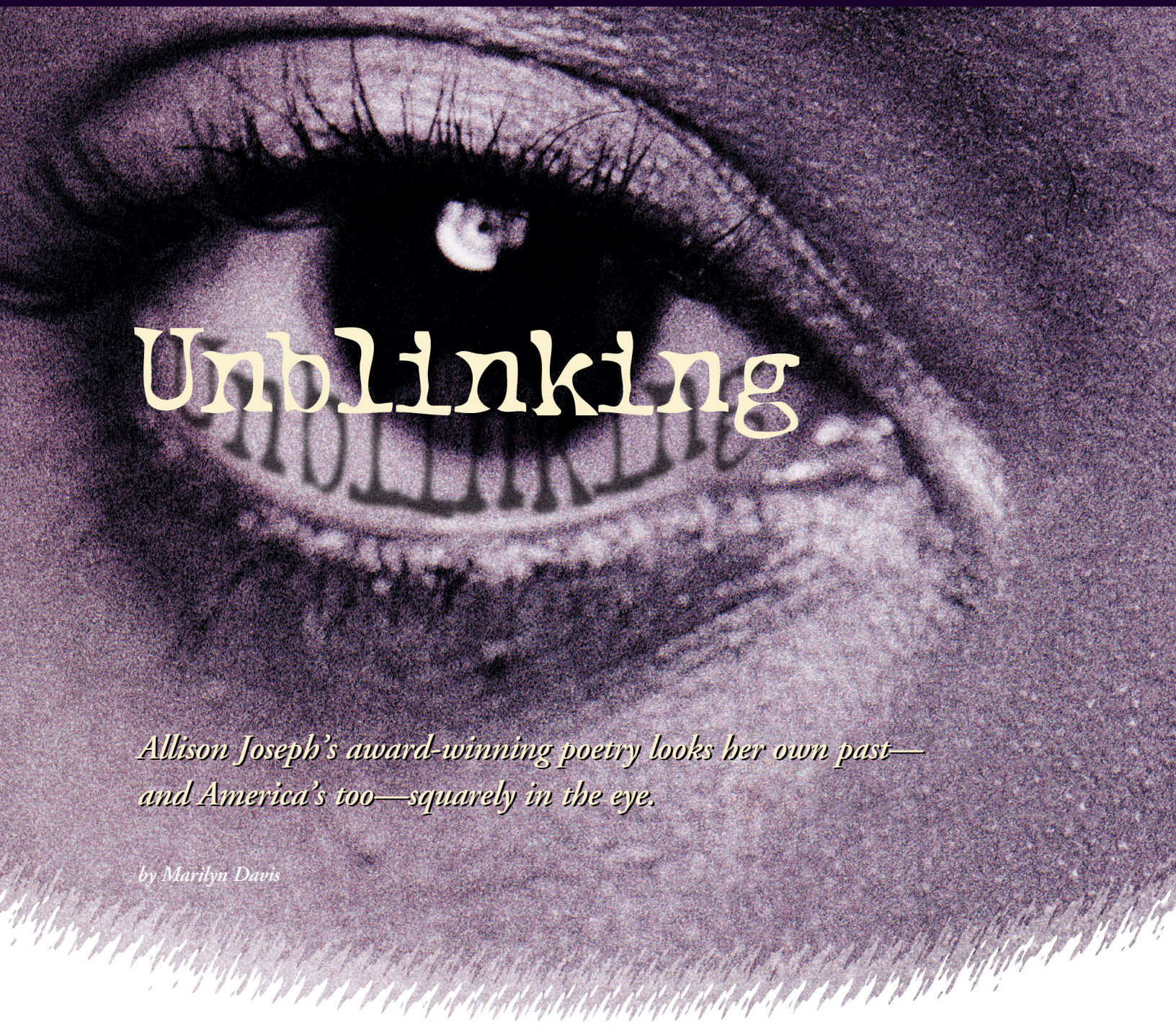
He and his students have determined the phases of various gases in this quasi one-dimensional state—that is, whether they seem to act more like a liquid or solid—and under what conditions phase transitions occur.

The properties of one-dimensional matter may, down the road, be useful technologically. Meanwhile, learning about them increases scientific understanding.

"There's no immediate practicality (to this part of the research)," says Migone, "but it's an exciting thing to be able to do. It's not every day that people have access to material in one dimension." ✦

For more information, contact Dr. Aldo Migone, Dept. of Physics, at (618) 453-1053 or aldo@physics.siu.edu.

▲ **Luke Heroux, an undergraduate in physics, works on a new data collection program for the nanotube research.**



Unblinking

Allison Joseph's award-winning poetry looks her own past—and America's too—squarely in the eye.

by Marilyn Davis

Allison Joseph is all grown up—has been for years. But she's built a reputation for poetry that's rooted in her childhood and adolescence, both the good and the bad, the ugly and the beautiful.

As a black girl coming of age in the Bronx, Joseph had a complex, interesting, and often oppressive world to negotiate. Her poems re-create that world, celebrating some things and indicting others, and they've been winning national plaudits for this associate professor of creative writing at SIUC.

Joseph's fourth book, *Imitation of Life,* was published in April 2003 by Carnegie Mellon University Press. A new manuscript of hers titled *Worldly Pleasures* has won the 2003 Word Press Poetry Prize and will be published next year. A first-place prize in the 2002 Wallace W. Winchell Poetry Competition, announced in February 2003, and other recent poetry awards from *Georgia State University Review* and *Yawp Magazine* (a literary

journal whose name alludes to a Whitman poem) have added icing to the cake.

Joseph's poems, usually written in free-verse stanzas, capture episodes from her youth and often skewer popular culture, from music to Barbie dolls. Many of these flashbacks focus on racial identity and on body image—especially the much-hated ritual of hair straightening, which recurs many times in her work.

One of her most touching poems is dedicated to the white friend in college who first cut her hair into a short natural. She marvels, "How strange that it's a white woman / who gives me back my hair / as dormitory bathroom light / sifts down upon us both, / and I touch the tender skin / where scalp meets nape / as if for the first time."

Joseph's work has won praise for its honesty and emotional insight. In "Bullies," for example, she recounts being physically coerced by two classmates into beating up a weaker girl. Humiliated, she turns her feeling of powerlessness against her victim. When the classmates finally tell her to stop pummeling the girl, she recalls, she didn't want to. She writes, "I wanted / to feel Donya's chest heave / just a few minutes more, / hear her sobs and know that I / caused them, nobody but me."

Although Joseph also writes lyric poems, such as love poems, she favors narrative poetry. "It feels very natural," she says. "I grew up in a house of storytellers, particularly my father. Since a lot of what I write comes out of memory and is at least semi-autobiographical, the storytelling impulse is strong."

She adds, "Of course, there are things that you alter, and that's the writer's prerogative. You can rewrite your history the way you prefer, which is why I say my poems range from semi-autobiographical to fully autobiographical."

Three things connected with New York City influenced Joseph to become a writer. The first was New York's famed poets-in-the-schools program, which got kids writing. "It was a sure way to get out of doing math," she jokes. But the program hooked her.

Then there was her library card, which allowed her to take out books from any branch library in the Bronx or Manhattan—a literary feast for a girl who was "always crazy about language and words."

Growing up, she read a lot of contemporary poetry, especially African-American writers. It was Gwendolyn Brooks (1917-2000) whose work taught her that "you don't have to write about Mount Olympus. You can write about your neighborhood—what's happening on the corner."

Finally, Joseph says she was fortunate to attend the Bronx High School of Science, which drew students citywide. "It was great training for a poet," she says. "My friends were from all racial and socioeconomic backgrounds."

By then she was writing regularly.

"Something about the turbulence of adolescence makes you want to do *something* creative," she says. "I thought as I got older I would stop writing about it, but I find adolescence, and popular depictions of it, very interesting.

"I like to see where my own life intersects or diverges from notions of what a teenager is supposed to be, or what a black person is supposed to be, or a woman." The clash between cultural expectations and reality is, she says, "a fertile source for any writer."

Some of Joseph's best work concerns her parents, who were of Caribbean heritage and had lived in England (where Joseph was born). Many of the poems in *Imitation of Life* feature her father, a funny but very demanding man who measured the acceptability of situations, she says, by how many black people were involved.

When Joseph chose to attend Kenyon College (Ohio) for its creative writing program—despite there being only two other black students in her freshman class—he did not approve.

"It's interesting that he's become such a thread in my writing, because he didn't want me to be a writer," she says. "My mother was much more accepting."

Joseph acknowledges her estrangement from her father most explicitly in the poem "Incommunicado," where she says she's lost her "daughter's logic / the sense that lets me know / exactly where my father is / at any given moment." She prefers to imagine him in the kitchen, cooking something she'd never eat, like "a mess of yams and pigeon peas / boiling over on the range top." She concludes:

If the food is filling, warm,
maybe he'll eat another plate,
maybe he'll think quietly

of me, daughter who turned her back,
left him behind for places on the map
no one else bothers with.

Maybe he'll think of forgiveness,
how it starts small—with one meal,
one bowl, one satiating, salty mouthful.

Joseph's current manuscript-in-progress includes many elegies to her father, who died in 1997. These poems are not free verse, but traditional forms: a sonnet sequence and some villanelles (poems, usually rhymed, with a prescribed repetition of certain lines).

The sonnet sequence started with one line that came to her after she and her sister picked up some of their father's effects at the Bronx County Courthouse. "The line was 'His credit cards were in a plastic case,'" Joseph recalls. "I realized that it scanned." The line is iambic pentameter: every second syllable is stressed, with five beats to the line.

▲ **Allison Joseph: "Since a lot of what I write comes out of memory, the storytelling impulse is strong."**

"I thought 'I only need 13 more lines for a sonnet, and then I'm done,'" she says with a laugh. But she had a serious reason for choosing the sonnet form for these extremely personal works.

"I had to have a mechanism to control the language," she says. Using the compact sonnet form "gave me a way to make the grief manageable. I think it's similar to the way we process grief—in bits and pieces."

Villanelles also were a natural choice. "Forms where lines repeat are good for grief," she says. The repetition, like an occasional drumbeat, lends a certain solemnity that suits the subject matter.

Joseph's poems aren't difficult to read, but readers in a hurry may miss the layers of deeper significance in these works.

In "Motives," for example, she writes of watching the wedding of Prince Charles and Lady Diana on the same day that her father uncharacteristically tries to save a sick, lame kitten. It draws his pity, perhaps, as an embodiment of his own failures and weaknesses. But the scrawny kitten dies the same day, unceremoniously ending up in the trashcan. Caught between this trauma and the fairytale on TV (in which, she notes, neither bride nor groom looks very happy), Joseph shrinks from both extremes, hoping that life has more to offer than such options.

Often Joseph puts a little verbal twist, a little punch, at the end of a poem that might be overlooked on a first reading. In the poem "Five and Dime," she tells of visiting the neighborhood dimestore as a girl, dreaming and browsing and sniffing bubble bath. Convinced she's shoplifting, the white manager shakes her, checks her empty pockets, then throws her out: "....*Don't you dare / come back in here without your mother,* he spat, / pushing me out onto the sidewalk in front / of that friendly discount store, that place for values," the poem ends wryly.

Joseph's first book, *What Keeps Us Here,* was published by Ampersand Press in 1992, the same year she earned her Master of Fine Arts from Indiana University. In 1997 she followed up with a double-hitter: *Soul Train* (Carnegie Mellon University Press) and *In Every Seam* (University of Pittsburgh Press).

She taught at the University of Arkansas in Little Rock for two years before coming to SIUC in 1994. Besides teaching and writing, she edits *Crab Orchard Review,* SIUC's international literary journal. Her work has been published in numerous anthologies, and her honors include the John Zacharis First Book Award, an Illinois Arts Council poetry fellowship, an IAC literary award, and fellowships from the Bread Loaf and Sewanee Writers Conferences.

In 1999, she started the Young Writers Workshop at SIUC, a four-day summer program for high school students that has grown in popularity each year. She says she "wanted to recreate that atmosphere of young people writing" that she remembered from her own high school days. Many of SIUC's creative writing faculty and graduate students are involved with the workshop, whose participants come from several states.

What does Joseph tell her students?

Above all, she says, "If you want to be a writer, *write.* It sounds so simple, but often people are more attracted to the romance of writing than the work itself. You have to feel compelled to write from somewhere beyond the need to make a living."

She adds, "I feel very blessed to be here, because we have such an excellent creative writing program, both on the graduate and undergraduate level. I have wonderful students who come from all over to learn to be writers." And her colleagues, she says, have a "relish for life that puts the lie to the notion that you have to be miserable to be a writer.

"If I can live to be 80 [like Gwendolyn Brooks] and write what I want to write, I'll be a very happy woman."

For more information, contact Allison Joseph, Dept. of English, at (618) 453-6833 or aljoseph@siu.edu.

Restoring an American Glory

▲ **Rare find: An American chestnut tree in Virginia.** ***Photo courtesy Paul Sisco, American Chestnut Foundation.***

"The American chestnut (*Castanea dentata* Marsh.) was once, by many accounts, the most valued hardwood species in the eastern United States. In some areas it made up almost half of the hardwood forest. But the chestnut blight fungus decimated the species in the early 1900s, and present-day forests are almost devoid of this useful and beautiful tree.

"Decades of breeding for blight resistance give us some optimism for restoring the American chestnut to our forests. However, little is known about ideal planting and growing conditions for successful reintroduction.

"Forests today are undergoing successional influences considerably different than those present at the turn of the century. Thanks to fire suppression, unnaturally high deer populations, and other factors, oak and hickory trees (formerly oak and chestnut trees) are being replaced by more shade-tolerant species such as maple. Therefore, we don't know whether planting and cultivation techniques that would have been appropriate for chestnut trees in pre-blight forests are still the best choice in present-day forests.

"High-value blight-resistant chestnut seed, when available for forest reintroduction, will probably remain in short supply for many years. As a result, it is critical—and urgent—for us to conduct strictly controlled tests to determine unequivocally the best methods for successfully planting American chestnut today."

—Jim Zaczek, assistant professor of forestry

Ed.—Dr. James Zaczek, who has studied planting and cultivation requirements for American chestnut in Pennsylvania, has received support from the American Chestnut Foundation and the U.S. Department of Agriculture's Cooperative State Research, Education, and Extension Service (CSREES) for ongoing experiments in Southern Illinois.

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