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Research Frontiers

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Research Frontiers, Fall 2003

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UNIVERSITY OF ARKANSAS

RESEARCH FRONTIERS

Exploring the
Immune System

Unveiling Middle East
Popular Culture

Modeling the
Impossible

Testing Textiles

Internet: www.uark.edu

FALL 2003





John A. White
Chancellor



Fayetteville, Arkansas 72701

Office of the Chancellor
<http://uark.edu/>

Message from the Chancellor:

In this issue of Research Frontiers, we are introducing a new feature that focuses on student research. Students, both graduate and undergraduate, benefit from research experiences on our campus. Each summer, many departments win grants from the National Science Foundation to sponsor Research Experience for Undergraduates (REU) students to come to campus for the summer. These students primarily attend non research-focused institutions. The program benefits both the students who visit our institution and the departments where they do research. Based on their positive undergraduate research experiences, many of these students return to join our graduate programs.

This year, the University of Arkansas hosted 52 REU students. They participated in projects that ranged from building sensors to detect marine toxins to testing micro-thrusters for spacecraft use. And two REU visitors, John Mischler of Augustana College in Rock Island, Ill., and Jon McBee, of Wheaton College in Massachusetts, traveled with geosciences professor Glen Mattioli and graduate student Elizabeth Van Boskirk of Yellville, Ark., to the Caribbean, where their experiences included a close-up view of an active volcano.

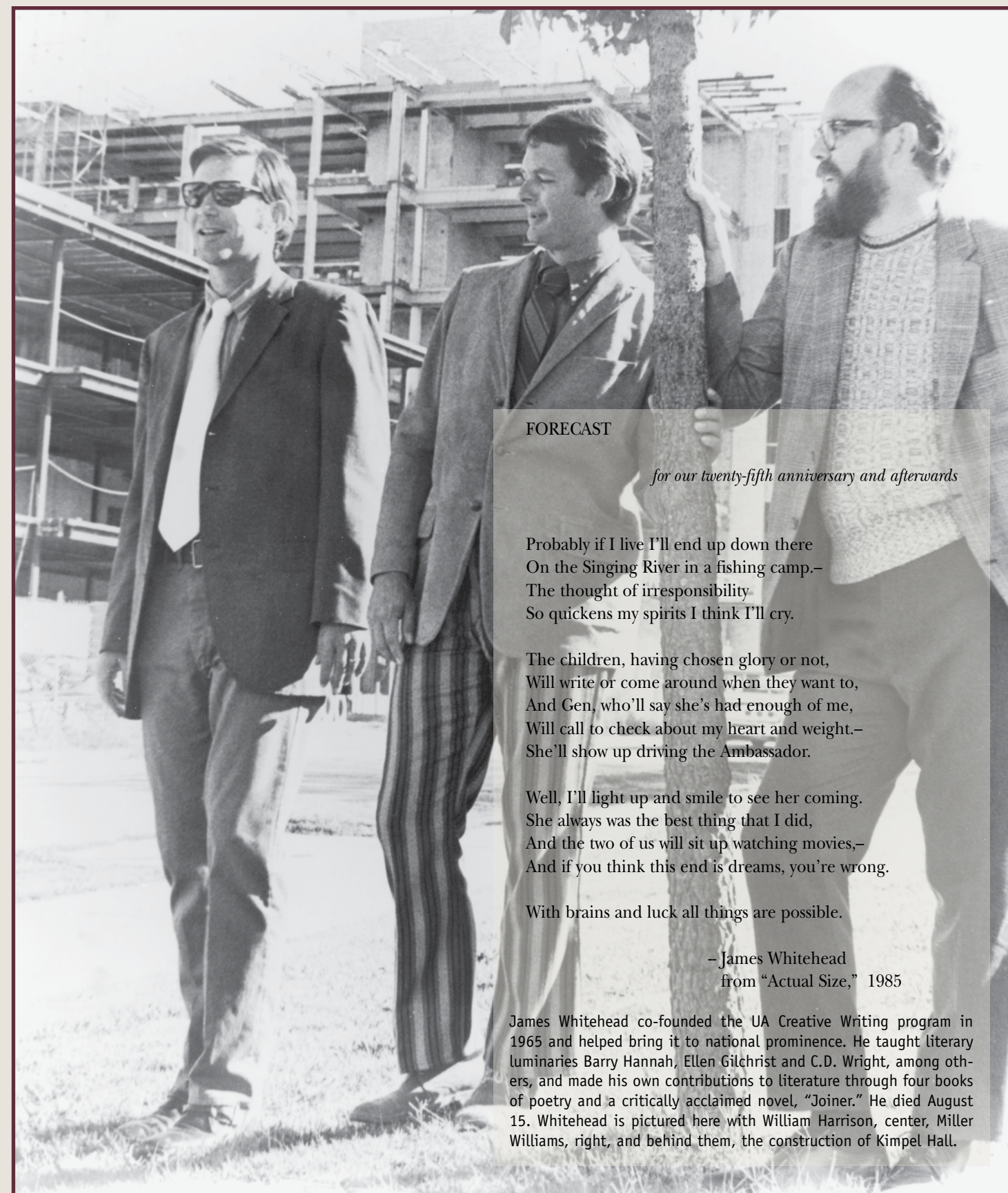
Many professors integrate undergraduate students into their research programs during the year through SILO-SURF grants designed to allow undergraduate students to initiate and complete research projects. Students may apply for these grants during their sophomore, junior or senior year and must maintain a 3.0 grade point average to be eligible. In the spring of 2003 about 30 students took advantage of this program to conduct research in tandem with professors.

One of them, Joseph Scott, worked with professor Charles Riggs in the College of Education and Health Professions on basic research into metabolic disorders. He has since graduated and will attend the University of Arkansas for Medical Sciences this fall. The details of his research and the work of several of his fellow students are told in the pages that follow.

Happy reading,

John A. White
Chancellor, University of Arkansas

The University of Arkansas is an equal opportunity/affirmative action institution.



FORECAST

for our twenty-fifth anniversary and afterwards

Probably if I live I'll end up down there
On the Singing River in a fishing camp.—
The thought of irresponsibility
So quickens my spirits I think I'll cry.

The children, having chosen glory or not,
Will write or come around when they want to,
And Gen, who'll say she's had enough of me,
Will call to check about my heart and weight.—
She'll show up driving the Ambassador.

Well, I'll light up and smile to see her coming.
She always was the best thing that I did,
And the two of us will sit up watching movies,—
And if you think this end is dreams, you're wrong.

With brains and luck all things are possible.

— James Whitehead
from "Actual Size," 1985

James Whitehead co-founded the UA Creative Writing program in 1965 and helped bring it to national prominence. He taught literary luminaries Barry Hannah, Ellen Gilchrist and C.D. Wright, among others, and made his own contributions to literature through four books of poetry and a critically acclaimed novel, "Joiner." He died August 15. Whitehead is pictured here with William Harrison, center, Miller Williams, right, and behind them, the construction of Kimpel Hall.

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Photo by CDC/George Stenhouse

MAKING MEMORIES

The immune system is the only thing that stands between us and microbial armageddon. One University of Arkansas researcher is working to understand the immune system so we can give it a boost.

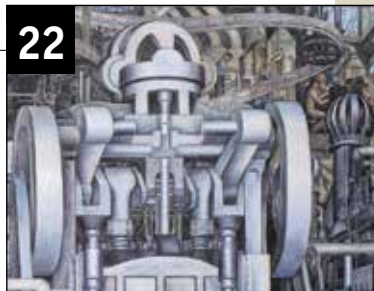
MIDDLEGROUND

Is it the lush land of harems, hashish and belly dancing or the region of religious strictures and social oppression? Studies of Arab popular culture, including film, music and poetry, tell the real tale.



INTUITIVE IMPOSSIBLE

Technology can make people's lives easier, but only if they use it. A University of Arkansas researcher studies why people accept technology, and why they don't.



TEXTILE TEST

One University of Arkansas researcher tests the mettle of a potential cash crop using boiling liquids, dyes, crochet hooks, glue and a lot of ingenuity.



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When exercise is bad for you, it can be because of a rare metabolic disorder. Students working with professor Charles Riggs seek to find out the mechanisms that underlie this disorder.

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Cover: A crowd waiting for oral polio vaccination medicine surrounds a city auditorium in San Antonio, Texas, in 1962. Although vaccines such as this one have reduced dramatically the number of people who succumb to infectious diseases, new ones continue to emerge. Biologist Jeannine Durdik studies the underlying mechanisms of the immune system, uncovering pathways that may lead to better ways to fight disease. Photo by CDC/Stafford Smith.

Shift In Reasonable Doubt Jeopardizes Presumption Of Innocence

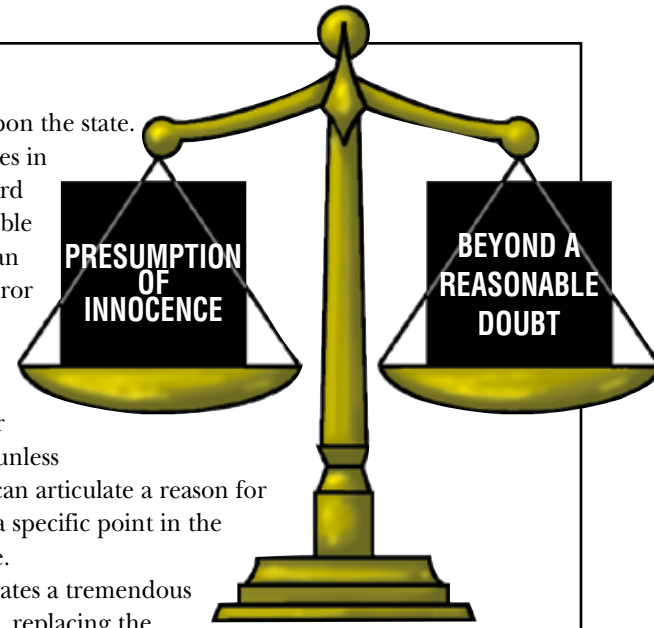
Most Americans learned everything they know about courtroom law from Perry Mason and Jack McCoy, including the cornerstones of the American judicial system — “presumption of innocence” and “beyond a reasonable doubt.” But law professor Steve Sheppard knows that the concept of reasonable doubt is changing, and that change may do away with the presumption of innocence.

“In practice, reasonable doubt doesn’t work the way we think it does. It has come to mean articulable doubt, a standard that has been directly attacked by federal and state judges on the grounds that it reverses the presumption of innocence,” explained Sheppard. “The state no longer has to prove its case, the defense does. The courts have moved the jurors’ goal from a vote for the state if the state can convince them of a fact to a vote for the state unless the defense can convince them of a certain type of doubt.”

The American judicial system is based on the presumption of innocence, which places the burden of proving the person

is guilty upon the state. But changes in the standard of reasonable doubt mean that the juror must presume that the prosecutor is correct unless the juror can articulate a reason for doubting a specific point in the state’s case.

This creates a tremendous imbalance, replacing the presumption of innocence with a presumption of guilt. A juror who votes to convict only needs to say, “I think he is guilty,” and does not need to give a reason. But a juror who votes to acquit must articulate precisely why he doubts the state’s case. ■



Researchers Use A New Method To Accurately Identify Bacteria

Researchers used a high-tech analytical tool to identify proteins in bacteria and showed it to be faster and more accurate than other currently used methods. The research could lead to better diagnosis and treatment of diseases and to early detection of biological terrorism threats.

Charles Wilkins, distinguished professor of chemistry and biochemistry, Jack Lay, director of the Arkansas Statewide Mass Spectrometry Facility, and their colleagues reported their findings in Analytical Chemistry.

Researchers usually identify bacteria by isolating them, growing them and examining them under microscopes, but this method can take weeks. After the anthrax outbreak in 2001, when people were exposed to the deadly bacteria through contamination of mail, researchers began to study rapid methods of bacteria identification in earnest. Many bacteria exist in both deadly and benign strains, so identification tests must work at the strain level. Researchers hope to get at this level by looking at proteins within bacteria and finding proteins unique to each strain.

Researchers seeking to speed up the identification process use matrix-assisted laser desorption/ionization mass spectrometry (MALDI-MS) to examine bacterial proteins and identify bacteria from specific protein markers. This technique, called time-of-flight mass spectrometry (MALDI-TOFMS), relies on ionizing bacteria, shooting the particles down a tube and measuring the

time it takes them to go down the tube, then calculating the masses by doing the same thing with particles of known mass and comparing the two. Although the method works more rapidly than microscopy, it leaves a big margin for error, and often cannot distinguish between specific proteins within the bacteria.

“There are other things besides mass that can affect how long it takes a particle to go down the tube,” Wilkins said.

The researchers compared the current method with Fourier transform mass spectrometry (MALDI-FTMS) — a technique that Lay calls “the Cadillac of mass spectrometry.” In this technique, a laser beam ionizes the bacteria, and the ions follow a circular path in a magnetic field, each one cycling at a specific frequency directly related to its mass and to the magnetic field strength. The researchers can measure frequency with precision, which allows them to make accurate calculations of protein masses.

The investigators used Escherichia coli, a well-characterized bacteria that lives in the gut of humans and other animals and occasionally causes illness. The E. coli genome has been mapped, and researchers can access information about its proteins in a computer database. Thus, they can compare masses obtained through mass spectrometry techniques with the information in the database and see how closely they correspond.

They found that the FTMS method had an error of 26 parts per million as opposed to an error of 200 parts per million for the time-of-flight method. ■

Entomologist Holds The Line Against Mosquitoes

Controlling mosquitoes to reduce risk of diseases like West Nile virus is largely a backyard effort, said entomologist Max Meisch.

“Community abatement programs alone won’t solve the problem,” Meisch said. “The primary battleground for West Nile virus is the backyard.”

Meisch has helped develop and implement effective mosquito abatement programs for rice-growing areas through his Arkansas Agricultural Experiment Station research in mosquito bionomics and control using non-chemical approaches and conventional methods.

The spread of West Nile virus has moved mosquito control higher on priority lists for many other areas of the state. The virus is believed to be spread across the country by birds and transferred to humans or other hosts by mosquitoes.

Three mosquito species proven to carry West Nile virus are found in Arkansas. The most common carrier, the Southern house mosquito, breeds in standing, polluted water, bites primarily at night and is limited to a short flight range.

“The best way to eliminate this pest is to clean up your own yard,” he said. “Clean out your gutters, don’t let rainwater collect in old tires or other containers and change the water often in pet bowls and bird baths.”

Although West Nile virus has grabbed headlines lately, mosquitoes transmit other dangerous diseases.

“West Nile pales compared to mosquito-borne malaria, the number one killer of children under five in the world,” Meisch said.

Malaria, once a problem in Arkansas, has been abated by anti-malarial drugs and residual house spraying. But the mosquito

Just before sunset, Max Meisch sets up an experiment near Stuttgart to measure the effectiveness of offset aerial spraying. The instrument measures the uniformity of spray coverage. The cage contains Anopheles mosquitoes, known as the “malaria mosquito” and common in Arkansas rice fields.



species that transmitted the disease is still found in the state.

St. Louis encephalitis also has occurred in Arkansas. It is closely related to West Nile virus and caused illness in people living in and around Pine Bluff in 1992.

The Asian tiger mosquito, a relative newcomer to the state, can transmit Dengue fever, which can cause deadly hemorrhagic fever and has occurred as far north as the Rio Grande valley on the Mexico-Texas border.

“The potential exists for this disease to spread here,” he said.

“Effective control requires an integrated approach. First, identify the species and go after the larva; hit them where they breed. Then control the adult population. An abatement program must have ‘backyard support.’ Property owners must do their part to eliminate breeding habitat,” Meisch said.

Even with quality abatement programs, Meisch says mosquitoes will always be around. “But we have the tools to effectively control the annoyance and dangers mosquitoes pose,” he said. ■

Restaurants Keep Consumers In The Dark About Nutrition

Most consumers have little knowledge about the types and levels of nutrients they are consuming and often underestimate the levels of fat and saturated fat contained in the large food portions served by many restaurants, according to researchers Elizabeth Creyer and Scot Burton, who teach marketing and logistics in the Sam M. Walton College of Business.

“American consumers obtain more than one-third of their calories from foods consumed outside of the home, and this percentage has been increasing in recent years. Therefore, we believe it is important for consumers to have a better understanding of the nutritional content of foods prepared by restaurants,” said Burton.

Creyer pointed out that many restaurants serve very large portions of food. “Few consumers seem to understand that foods served by many restaurants often contain high levels of

fat, saturated fat and cholesterol. Many consumers just don’t realize they are eating several servings of foods high in fat and calories in a single setting.”

The researchers conducted three experiments to determine consumer response to health claims and nutrition information in two contexts, restaurant menus and food packages to determine how consumers use health claims and nutrition information to evaluate food products.

“The results of this research suggest that the context within which a specific menu item is evaluated matters,” said Burton. “When the alternative menu items were described by favorable nutrition information, a nutritious target item had a less positive effect on attitudes than when no nutritional information was present for the other choices. On the other hand, when the alternative menu items were unhealthy, favorable nutrition information about the target item had very positive effects on nutrition and health evaluations of the food item.” ■



Advertising For Prescription Drugs: Dangerous To Your Health?

Graduate student Juhhee Cho investigated whether television ads for prescription drugs contained enough information to help consumers make informed choices. After analyzing ads for the 11 most heavily advertised drugs between 1999 and 2000, she concluded that the ads were neither balanced nor informative, a finding that suggests the FDA should more closely monitor these ads to safeguard public health.

Cho found that prescription drug ads appeared to work, since sales of the 50 most heavily advertised drugs increased 32 percent between 1999 and 2000. Moreover, total expenditures for advertising increased twenty-fold during the 1990s, growing from \$25 million in 1992 to almost \$1.9 billion in 1999.

“Drug sales increased as advertising increased,” said Cho. “Twenty-two of the top 50 most heavily advertised drugs in 2000 were also on the list of the 50 best-selling drugs that year.”

Such advertising influences how consumers regard prescription drugs. A 2000 survey in the *Journal of Health Communication*, showed that 43 percent of respondents believed only completely safe drugs could be advertised in popular media.

“Further research revealed that these advertisements leave out important safety information and exaggerate the product’s benefits, as noted by frequent FDA letters documenting objections to such ads. Most of these advertisements do not have educational value and do not mention costs,” said Cho.

Such advertising can lead consumers to ask their doctors for drugs they don’t need. Cho discovered that while the five most advertised and purchased drugs in 2001 were for depression, ulcers, high cholesterol, osteoarthritis and non-viral infections, the five most common health problems of Americans were heart disease, malignant neoplasms, diabetes, chronic lower respiratory disease, and strokes.

“Clearly, the advertising is not offering information on the most common conditions from which Americans suffer. One possible explanation is that pharmaceutical companies make large profits on these drugs,” said Cho.

She believes that these TV ads should either be banned, or advertisers should be required to include more information, especially on side effects.

“The FDA should be much more aggressive in setting and enforcing guidelines for such ads to protect and inform the public more effectively about the risks and benefits of drugs,” Cho said. ■

Architecture Class Sculpts With Equations

Two hours spent dipping pipe cleaners into bubble solution yielded insights into minimal surfaces like soap films and liquid interfaces for architecture and computer science students. In the process, they also learned about the mathematics of digital modeling, which is competing with ruler and pencil in conceptualizing and rendering two- and three-dimensional architectural representations.

The interdisciplinary course, taught by architecture professors Lynn Fitzpatrick and John M. Humphries and mathematics professor Chaim Goodman-Strauss, let students explore minimal surfaces by using Surface Evolver software and the School of Architecture’s CNC router, a computer-controlled milling machine. Using equations entered by the students, the CNC router carved forms from hardwoods such as walnut, cherry, maple and oak, as well as inexpensive plywood and housing insulation board. Some students milled molds to form shapes out of plaster, concrete and papier-mâché.

“There’s a lot of contemporary work in architecture that’s skirting around mathematics, philosophy and science that’s outside the usual realm of practice,” Humphries said.

“The curl of a leaf, the cracks in the sidewalk — mathematics describes the forms around us,” Goodman-Strauss said. “By gaining control of the math, the students gain control of the machinery. Mathematics is a wonderful design tool.”

The students produced strikingly original architectural models and screens. Andy Kim created a seven-foot-high hinged panel that transforms from wall surface to enclosure formed by milling and stacking 1,350 plywood ribs. A birch screen created by Jena Rimkus and Maury Mitchell was composed of six triangulated panels inspired by an aperiodic pinwheel tiling. Though they’re original and beautiful — the Holy Grail of designers — the models are secondary to the course’s main goal: to introduce mathematical principles into digital modeling.

The course also offered students hands-on experience with the CNC router, which translates software files into three-dimensional models. The router gives students an opportunity to manufacture work that would otherwise stay on a computer screen. ■



Photos by Russell Colburn

Study Suggests Mixed Effects Of Pre-School Day Care

Researchers have found that children who spent a substantial amount of time in pre-school day care exhibited higher levels of academic readiness, more behavioral problems and lower levels of self-control in kindergarten and first grade than children who spent less time in non-parental care.

Gary Ritter, assistant professor of education policy, and Ronna Turner, assistant professor of education, leadership, counseling and foundations, presented their findings at the 2003 biennial meeting of the Society for Research in Child Development.

The researchers used statistics on approximately 17,000 students from nearly 900 kindergarten programs in the Early Childhood Longitudinal Survey (ECLS-K) database. These students were then assessed again in first grade. Ritter and Turner sought to test the hypothesis put forward by Jay Belsky with the National Institute of Child Health and Human Development that children who spent more time in non-parental care early on are more likely to be academically prepared but less well-behaved in school.

They broke down pre-school care into several different categories: parental care, center-based care, Head Start programs, in-home care by a caregiver and other care. They

also broke down the hours spent in non-parental care into none, less than 10 hours, 10 to 30 hours and more than 30 hours. And they looked at the age at which children entered non-parental care.

Teachers and parents of children in the study were asked to assess aspects of the children’s behavior in the fall of kindergarten and the spring of first grade. They were asked to look at approaches to learning, self-control, interpersonal skills, externalizing problem behaviors and internalizing problem behaviors.

They found that children in care for more than 30 hours a week of formal day care and children who entered non-parental care before age one exhibited the highest tendency to externalize behaviors when compared to students who spent less time in day care. This effect held true for students in kindergarten and first grade, the researchers found.

The study also found that students in day care situations performed better on kindergarten reading and math tests than did their stay-at-home counterparts.

“In sum, kids in more formal day care were more prepared cognitively and more troubled behaviorally when they entered kindergarten than kids in parental care,” Ritter said.

“However, the differences in academic performance at the beginning of kindergarten diminished by the end of first grade,” Turner said. ■

Urbanization Increases Rainfall In Coastal Areas

Phenomena that influence weather include the jet stream and El Niño, but Steve Burian wants to add Houston to that list because he found that large urban areas like Houston can influence their own weather and areas downwind.

Burian, assistant professor of civil engineering, and J. Marshall Shepherd of NASA Goddard Space Flight Center conducted a unique study to quantify the impact of urbanization on rainfall. Their conjunctive analysis, which used space-based and land-based rainfall data, shows elevated rainfall amounts within and directly downwind of Houston.

“There is increasing evidence that large coastal cities like Houston can influence weather through complex urban land-use-weather-climate feedbacks,” explained Burian, assistant professor of civil engineering. “During urbanization, natural land covers are removed and replaced by artificial structures and surfaces like buildings, parking lots and sidewalks. Ornamental landscapes replace natural trees and vegetation and the soil structure is modified.”

These changes impact the exchange of water and energy between the land and the atmosphere. As a result, temperature, wind and precipitation patterns change.

Burian and Shepherd used data from the world’s first satellite-based precipitation radar aboard NASA’s Tropical Rainfall Measuring Mission and 13 years of rainfall data from a dense rain gauge network in Houston.

“We found that there are nearly two times as many occurrences of rainfall from noon to midnight in the urban area compared to the control area,” said Burian. “This anomaly has significant implications for flood control in Houston.” ■

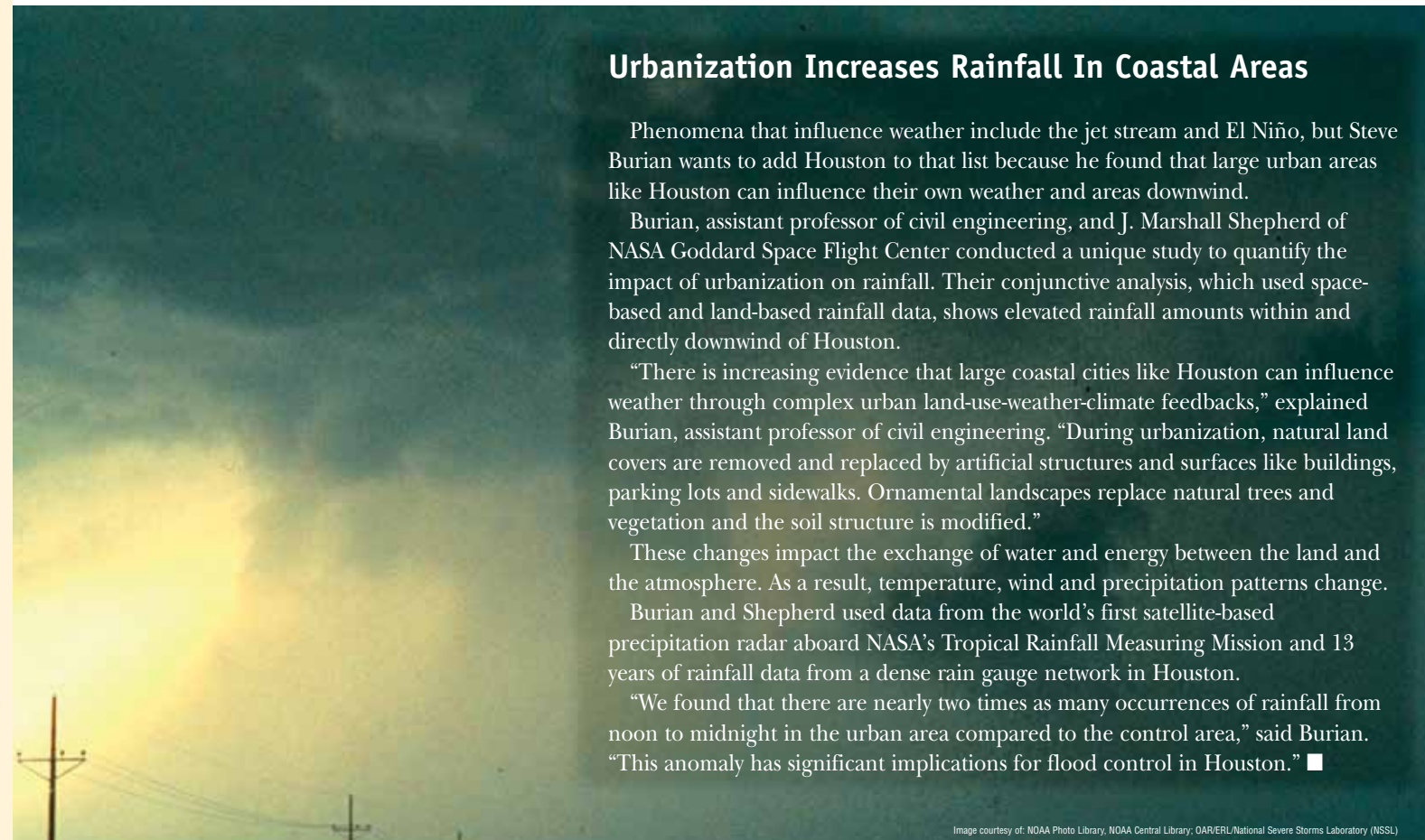


Image courtesy of: NOAA Photo Library, NOAA Central Library, OARERL/National Severe Storms Laboratory (NSSL)

By Melissa Lutz Blouin

Students Help Professor Further Research on Fat Metabolism Disorders

For some people, exercise brings more pain than pleasure in the form of muscle weakness, cramps and protein loss. These people suffer from a relatively rare fat metabolism disorder that affects the skeletal muscles and, perhaps, the heart. Kinesiology professor Charles Riggs and his students hope to contribute insights into how the fatty acid oxidation disorder works so that people who suffer from it might enjoy an improved lifestyle and the ability to exercise safely.

Last year seniors Joseph Scott of Winthrop, Ark., Erin Kissinger of Bentonville, Ark., and junior Stephanie Koonce of Uniontown, Ark., worked in Riggs' lab side-by-side with the professor and his graduate students. Riggs works with an experimental mouse model obtained from researchers at the Vanderbilt University School of Medicine to study the physiological consequences of exercise in mice with fat metabolism disorders. These mice lack an enzyme that allows them to metabolize very long chain fatty acids, and they develop symptoms similar to those humans experience with the disorder — fatigue, hypoglycemia and musculoskeletal or cardiac myopathy.

Scott, Kissinger and Koonce put the mice through their paces, exercising them on a treadmill with a variable speed and gradient, a miniature version of the equipment used for a stress test in humans.

Scott won a SILO-SURF grant to support his

research. He studied the effects of exercise training, particularly high intensity training, on the muscles' ability to oxidize very long chain fatty acids.

"I liked working on a project that had the potential to help many people," Scott said. He is at the University of Arkansas for Medical Sciences this fall, and said he thinks the lab experience will help him in whatever future career he decides to pursue.

Kissinger studied differences between male and female mice in post-exercise recovery. A previous study had suggested that female enzyme-deficient mice recovered muscle strength more quickly after exercise than male enzyme-deficient mice did. Kissinger replicated the study.

Kissinger measured muscle function at different time intervals post exercise to determine how depressed muscle function became after exercise.

"I learned how to use what I had learned about scientific studies in class lectures in a practical application in the lab," she said. "I learned that anyone can perform research and be good at it; it just takes time and lots of practice." Kissinger added that the experience helped prepare her for the future, although she remains undecided as to what she wants to do next.

Koonce, who will continue working with Riggs this year, helped collect muscle tissue from the mice and



From left, Holly Shinnen, graduate student, Charles Riggs, professor, and Erin Kissinger, undergraduate student.

Photo By Russell Cottrien

performed biological assays.

"I love ... interpreting the data from the assays into information that could potentially improve someone's life," Koonce said.

"The most important thing that I learned...is that working in research is an attainable goal. It is not something that only the smartest and most talented people can do; it is something every student could be involved in if they wished," she said.

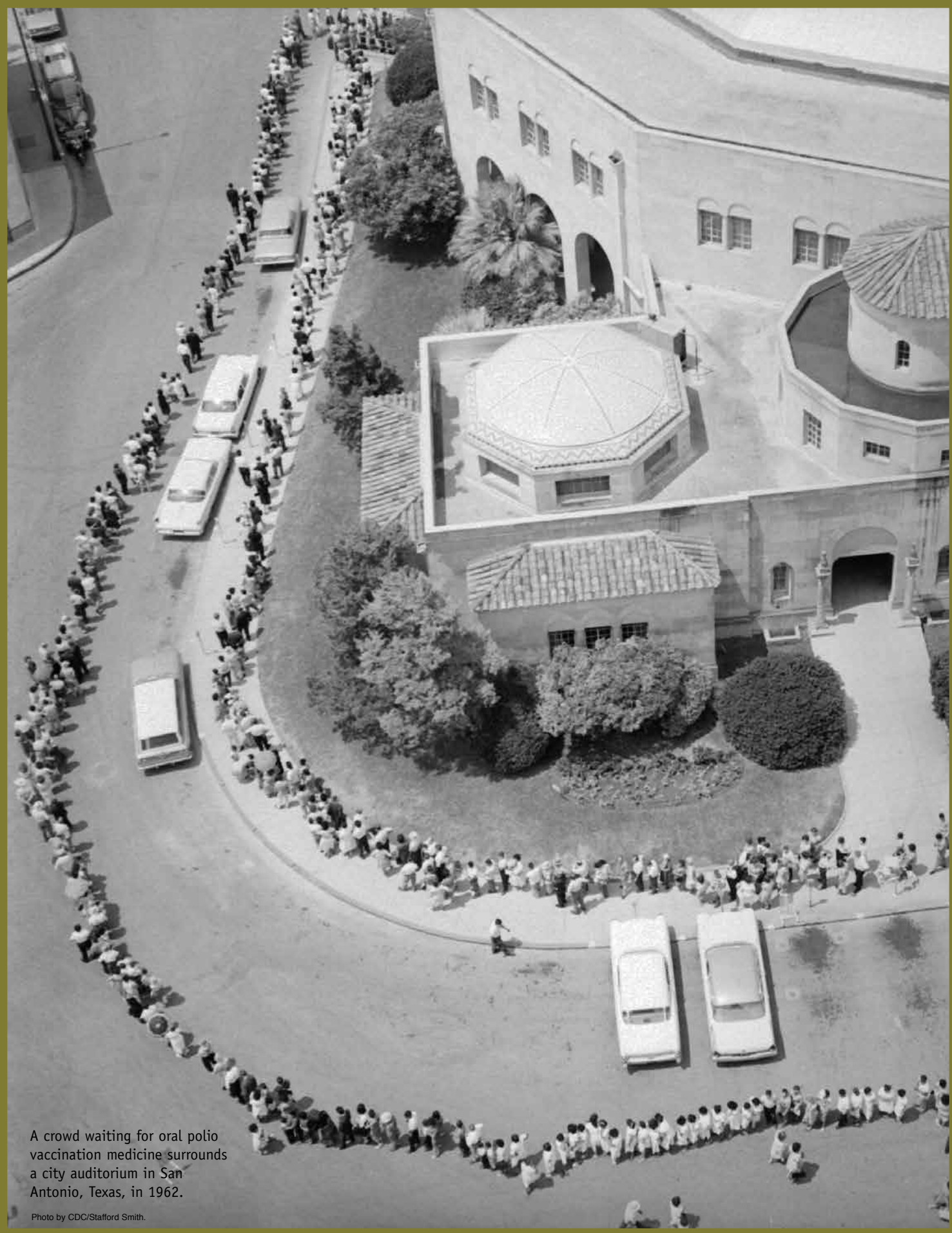
All three students agreed that they enjoyed getting to know a professor outside the classroom. And the sentiment is mutual.

"I learn as much from them as they do from me," Riggs said.

The earlier these students get involved in research, the easier it is for them to compete for grants, and the more they get from the experience, Riggs said.

This fall, new students will begin working in his lab with Koonce, following in the footsteps of Scott and Kissinger.

"Hopefully the students coming on this fall will replicate the studies, build the numbers and add their own ideas," helping bring better understanding of this debilitating condition, Riggs said. ■



A crowd waiting for oral polio vaccination medicine surrounds a city auditorium in San Antonio, Texas, in 1962.

Photo by CDC/Stafford Smith.

The Last Defense

By Melissa Lutz Blouin

IN THE PAST TWO YEARS, NEW WORDS HAVE CREPT INTO THE VOCABULARIES OF AMERICANS: WEST NILE VIRUS, SARS, MONKEYPOX. AS PEOPLE STRUGGLE TO UNDERSTAND WHAT HAPPENS WHEN DISEASES JUMP FROM ONE CONTINENT TO ANOTHER, A UNIVERSITY OF ARKANSAS RESEARCHER AND HER COLLEAGUES ARE LOOKING AT THE MECHANISMS THAT UNDERLIE THE IMMUNE RESPONSE TO INFECTION. SUCH AN APPROACH COULD LEAD TO A MORE UNIVERSAL WAY OF FIGHTING EMERGING DISEASES.

When Tammy Kautzer purchased two small prairie dogs at a 4-H pet exchange in Wausau, Wisc., on Mother's Day, she had no idea that her life would soon be linked to a little-known country in Africa. She brought the two tiny mammals to her home in Dorchester,

Wisc., and introduced them to her 3-year-old daughter, Schyan. Two days later, one of the animals appeared to be sick. Schyan tried to play with the animal, and her mother told her to put it back in its pen. When Schyan was putting it away, the prairie dog bit her on the finger.

All the devastation caused by the wars and weapons of the 20th century — the nuclear war heads, the mines, the tanks and machine guns — pale in the face of the world's most pervasive killers. Unseen, they invade by stealth and kill from within. The names of some of these threats caused the most robust people to tremble in the early 1900s — smallpox, diphtheria, polio. And influenza in 1918 wiped out millions of people world-wide.

With the advent of vaccines in the 1950s and 60s, many researchers thought humans might win the war against microbes. Indeed, the year 1977 marked the last case of smallpox seen in the world. To most Americans, influenza seems more an inconvenience than a major threat. And we have vaccines that protect against diphtheria, polio and other diseases that once plagued humans.

Yet even as certain viruses and bacteria retreat, others have moved forward to take their places, and they have taken on equally ominous forms. Human immunodeficiency virus, which causes AIDS, emerged in the 1980s. The Ebola virus made a gruesome debut in Africa in the 1990s. Monkeypox and West Nile Virus, once native to Africa, have jumped continents to become a world-wide problem. And a new pathogen that causes Sudden Acute Respiratory Syndrome (SARS) has emerged, spreading rapidly from person to person seemingly by close proximity to someone with the disease.

Traditional vaccines rely on the body's recognition of and response to a pathogen. When foreign microorganisms enter the body, the immune system sets to work to disable or destroy them. The immune system produces both antibodies and cells that bind to the microorganisms and shut them



Prairie dogs became an inadvertent carrier of Monkeypox — a disease introduced from Africa to the United States.

Photo by Tom Lutz

down. After the invasion is turned back, a few cells that “remember” the microorganism remain, in case of another incursion. These memory cells create a faster response if the pathogen tries to invade again, often preventing illness before it begins.

Traditional vaccines use killed disease-causing organisms, parts of organisms, weakened organisms or low-level toxins to induce immune responses specific to particular diseases.

This, in turn, boosts the immune system's memory of this particular disease-causing microbe, so that if it tries to invade the body again it is quickly vanquished. Unfortunately, immunity produced by these non-threatening traditional vaccines is weak.

Today's researchers continue to seek ways to make new vaccines specific to various organisms, but University of Arkansas professor Jeannine Durdik has taken a different path. She's examining the basic mechanisms the immune system uses to fight disease in hopes of finding a universal pathway that might be used as the basis of making the specific vaccines better and stronger than they are in their current forms.

At first Schyan Kautzer's bite swelled and reddened a little, but it didn't seem unusual. However, by the next weekend Schyan had a fever that wouldn't abate. On Monday the Kautzers took their daughter to a doctor at the Marshfield Clinic, and while they

were there had him look at the bite. He immediately referred them to Kurt Reed, an infectious disease pathology specialist and director of the clinical research center at the Marshfield Clinic Research Foundation.

Schyan developed red spots on her body. Her fever shot up to 104 degrees, and she refused to eat or drink. The physicians hospitalized her, put her on an IV, gave her antibiotics and began to run some tests. The day Schyan entered the hospital, the sick prairie dog died.

“For the first three days she just lay there, mostly sleeping, crying when she woke up,” said Kautzer. “Then she woke up and said, ‘Mommy, did I die?’ And I just cried.”



A mother and children in an immunization clinic, 1977, awaiting immunization by a seated nurse preparing the vaccine dosages.

Photo by CDC/Meridith Hickson.



A young child undergoing immunization with a jet injector at the Well-Baby Clinic in Dekalb County, Georgia, 1977. A jet injector is a device that uses gaseous pressure to propel drugs or vaccines through the outer layers of the skin, and into the underlying subcutaneous tissues. This is accomplished without the use of needles.

Photo by CDC/Meridith Hickson.

The doctors took a biopsy of the tissue from the red spots, but it did not test positive for cowpox or herpes virus, two of their first guesses. Three days into Schyan's hospitalization, she wasn't responding to antibiotics, and they still didn't know what was wrong. Then her mother started to get itchy red spots on her body.

Durdik and her colleagues have started to examine immune memory in an attempt to understand how it works within the immune system. Durdik and her colleague, Satyajit Rath of the National Institute of Immunology in Delhi, India, wanted to look at ways to enhance immune system memory that may potentially augment the effectiveness of vaccines.

A teaspoon of blood contains perhaps a million lymphocytes, cells that help kill or disable illness-causing pathogens. Of these million lymphocytes, perhaps 10 recognize a particular pathogen. In sheer numbers, a flu virus or pneumonia bacterium could easily overwhelm the lymphocytes, but when they recognize the enemy, the lymphocyte cells multiply by dividing, creating huge numbers of cells specific to warding off the invading pathogen.

However, once the intruders have been shown the door, the lymphatic system needs room for other types of cells to remain vigilant for all types of diseases. So most of the cells specific to the pathogen must die. The rise and fall of these cells occurs almost simultaneously.

The cells that don't die — the ones left behind when the infection recedes — confer immune memory in the body. If the same pathogen invades the body again, these cells will rise up and stop it before another infection can begin.

Up to now, vaccines have operated on the premise of stimulating the immune system memory by exposing the lymphocytes to a small part of the pathogen. But Durdik and Rath want to look at the cell build up and death to see if

control at the immune system level is possible.

"If we can control cell death so it goes from 100 to five instead of 100 to one, we have a five-fold increase in memory," Rath said.

One of the molecular players in cell death turns out to be a drug commonly used to thin blood. They measured the immune response in chickens that received the drug with the vaccine and those that didn't, and found that the drug-enhanced animals had a higher level of immune response than the ones who just received the vaccine.

"With one week of treatment, long-term persistence of immune memory is significantly improved months later," Durdik said.

In addition, the nature of the drug has led Durdik and Rath to other ideas on how the cell death pathway is controlled. They are now looking at common signaling molecules like nitric oxide, which plays a major role in controlling dieback or expansion of immune cells and in determining the amount of memory that persists.

Tammy Kautzer's illness progressed from bumps to cold sweats at night.

"I couldn't stay warm enough, and yet I was drenched," she said. Her glands swelled to the point where it hurt to swallow. A few days later, her husband also developed symptoms.

"You felt like you had the flu," she said.

Schyan spent a total of seven days in the hospital. She didn't respond to several

different types of antibiotics, but Kautzer finally noticed that one eye, which was swollen shut, seemed to be improving. The Kautzers took their daughter home and felt better in a little under a week.

The day after Schyan left the hospital, a biopsy from Tammy Kautzer detected an orthopox virus — monkeypox, a disease formerly found only in Africa.

The news exploded on the national scene as the Centers for Disease Control and Prevention and other government organizations attempted to trace the origins of the microbe. They traced it from the

Every hour, 1500 people die of an infectious disease. Over half of these people are children under the age of five. Vaccinations for specific diseases have helped reduce the number of deaths, but new microbial threats emerge all the time.

infected prairie dogs bought at a swap meet to SK Exotics of South Milwaukee, then to a wildlife importer in Texas. The prairie dogs were housed with a Gambian rat, three dormice and two rope squirrels that were shipped from Ghana on April 8.

As people grow older, they seem to lose the protection that the immune system afforded them when they were younger. Indeed, studies have shown that most vaccines do not work on the elderly, and that vaccine-induced immunity can wear off as people grow older. So it seems that older people stop maintaining immune memory, and Durdik and Rath ask the question: Why?

To answer this question, Durdik turned to mice, because mice age rapidly, becoming old at about 16 months.

She looked at cell explosion and cell death by taking young and aged mouse T-lymphocytes and exposing them to a trigger that causes the lymphocytes to multiply and then die. She then took samples of the cells at 10, 20, 30 and 40 hours and examined the samples for differences.

Durdik and Rath used a flow cytometer to track dividing cells. All of the original sample cell proteins are marked with fluorescent markers, then the cells are sent in a continuous stream through a laser beam that marks

their journey. As the cells divide to create new generations, the new proteins made do not fluoresce. These proteins dilute the old ones. As the cells divide, the next generation is half as bright as the previous generation, and this can be translated into a measurement of new cell growth.

The researchers can follow cell division for about seven generations. Durdik creates contour plots that show how the cells proliferate over time.

"Expansion upon stimulation does not appear to be dramatically different between young and aged cells," she said.

However, the story changes when it comes to cell death. Immunologists know that a normal cell won't let much through its membrane.

"It's an excellent barricade," Rath said.

When cells die their membranes become leaky. So the researchers added a fluorescent dye that brightens when it comes in contact with DNA. This second dimension of fluorescence tracks the "dead guys," Durdik said.

The contour plot of cell death clearly shows that lymphocytes die off more swiftly and completely in aged cells than in young cells. Like a person who can't remember what the car keys are for, the aged immune system appears to lose the ability to retain the memory of past bacteriological and viral insults.

The next step in Durdik's lab will be to look closely at the cell death patterns to determine why this mechanism changes between youth and age. The answer may provide a new way to boost the immune system and keep it safe from the perils that beset it daily.

The Kautzers represent three people sickened in an outbreak that infected 79 people with a virus previously unseen in the United States. Their story shows how diseases once indigenous to isolated parts of the world can now travel

globally, how a rodent from a remote region of Ghana in Africa can affect the life of a three-year-old girl and her family in Wisconsin.

Monkeypox has no cure, and no vaccine specific to its prevention. In Africa, the virus kills one to 10 percent of people who contract it. Its sudden emergence on the North American continent illustrates how ill prepared we are as a global community to deal with the consequences of a microbiological invasion.

Durdik's research will not create immediate solutions to this problem. However, her research provides a fundamental backdrop for addressing concerns about emerging infectious diseases in a more universal way than through traditional vaccines. ■

Before vaccination programs became common practice, parents in the United States could expect:

Polio to paralyze 10,000 children per year

German measles to cause birth defects and mental retardation in 20,000 newborns

Measles to infect 4 million children and kill 3,000 a year.

Whooping cough to kill 8,000 children, mostly infants, in a year.

Diphtheria to be the most common cause of death in school-aged children

Haemophilus influenzae B to cause meningitis in 15,000 children every year, leaving many with permanent brain damage



Gray and balding, the old mouse, left, was well past middle age at 16 months. Because mice age quickly, they make a good model for studying the effects of aging on the immune system. Durdik has found that when faced with disease, T cells in old and young mice replicate quickly, but more cells die off in old mice than in young mice, which implies that the aged immune system doesn't "remember" the assault as well later on.

Photos by Russell Coltrien

by Allison Hogge

Unveiling Arab Popular Culture

It's an area that once titillated the American imagination with its exotic and sensual tastes, its belly dancers, its harems, its dens for opium and hashish. But with decades of political and religious strife, with the reports of violence, the pictures of shrouded women and the events of September 11, the Middle East now summons a very different picture in the American mind — one increasingly framed by zealotry, intolerance and oppression. In their studies of Arab media and culture, three University of Arkansas researchers in the Center for Middle East and Islamic Studies — one historian, one anthropologist and one literary scholar — remind us that neither stereotype holds true. Though separated by geography and genre, an overview of their research on movies, music and poetry gives a more accurate picture of

Middle East culture, one deeply reflective of politics but steeped in the passion and rebellion, the realism and hope with which Arab citizens regard their region and its future in the world.

Cairo, Egypt

On a cool evening after the Ramadan holiday people emerge from homes and hotel rooms to stroll the downtown streets. Couples and crowds intermingle, a mix of Western style and more traditional dress — some women in sun dresses, others wearing the *hijab*, or head scarf, to cover their hair.

Outside the Metro theater, a line snakes down the sidewalk

where patrons wait to buy movie tickets. In pairs and groups, women cut to the front of the line — a privilege granted by tradition — while men wait to slide their money through the box office window and to follow an usher through the darkened theater to the seat assigned on their ticket.

Down the street, at one of Cairo's grand, refurbished movie palaces, women in gowns and men in formal garb file into plush seats as if indulging in a night at the opera. And on the outskirts of the city, lights flicker across the screens of open-air theaters, where men gather in raucous, jovial crowds.

These audiences may have bought tickets to the same Hollywood blockbuster you and I watched last summer. But it's equally likely that they've come to view one of the numerous original films produced by Egyptian writers, directors and actors. As the main production center of Arabic-language movies in the Middle East, Egypt boasts nearly a century of cinematic history. And although few Westerners have seen an Egyptian movie, it's not for lack of material. At the height of cinematic production in the 1950s-70s, Egypt released more than 50 films per year.

Joel Gordon, an associate professor of history, is one of the first American scholars to critically examine Egyptian films in the context of political and social history. In the summer of 2001, during his last trip to Cairo, theaters announced the latest Hollywood action film, "Pearl Harbor," on giant marquee. But Gordon sought the venues where Egyptian films, new and old, regularly hit the screen.

Because these films are nearly impossible to find in the United States, Gordon's

trips to Egypt require countless hours scouring movie listings, sitting in theaters and recording old films as they are broadcast on TV. He brings empty suitcases to carry video cassettes back to the States, and each time friends travel to the region, he equips them with a shopping list of movie titles.

This fascination with Egyptian cinema grows out of research Gordon conducted through the 1990s for his book "Revolutionary Melodrama: Popular Film and Civic Identity in Nasser's Egypt," published in 2002.

"I collected a lot of video during my research, talked to Egyptians socially and watched television constantly for the reruns of old films," Gordon said. "I conducted a lot of interviews with actors, directors, critics and gov-

ernment censors. But my most important research tools were a VCR and an antenna across the street that had to be jimmed once a week."

Gordon's book shows how, in the wake of colonial occupation, Egypt's first independent regime attempted to shape national identity through popular culture. Just a few years after a 1952 mil-



Photo submitted

From left: "Bad girl" Nadia Lutfi in "The Dark Glasses"; 1960s Egyptian starlet, Magda; Anwar Wagdi, Zaki Rustam and Sulayman Nagib in "Daughter of Nobility"; Omar Sharif.

Center, next page: A movie marquee in downtown Cairo.



Photos submitted



Dablat Galbi (Ruin of my Heart)

I don't sleep; dreams do not come. My house is empty,
yeah, my house is empty.

When you are far away from me, I am caught in mad-
ness, yeah, caught in madness.

Oh, ruin of my heart, oh yeah, ruin of my life.
Oh, ruin of my heart, oh yeah, ruin of my life.

You stayed in my heart like a bird's nest in a tree, yeah,
like a bird's nest in a tree.

Oh, your words wounded me, not the knife, yeah, not
the knife.

....

I don't sleep; dreams do not come when you are away,
yeah, when you are away.

Tell him to manage on his own with what he lost, yeah,
with what he lost.

The slave of passions, may God help him, yeah, may
God help him.

Why, why do you destroy the man of passion, yeah,
destroy the passion, yeah?

Oh, they blinded my eyes and did the same to my
heart, yeah, did the same to my heart.

— Rai lyrics translated by Marc Schade-Poulsen
in "Men and Popular Music in Algeria: the Social
Significance of Rai."

LISTEN TO RAI ON THE WEB!

Visit the Research Frontiers Web site
[http://advancement.uark.edu/pubs/
Research_Frontiers/](http://advancement.uark.edu/pubs/Research_Frontiers/) for links to Rai
music sites and more information.

itary coup placed Gamal
Abdel Nasser at the head of Egypt,
the new leader moved the nation's film industry
under the authority of his Ministry of Guidance and
Culture. Egyptian cinema had enjoyed a successful history dat-
ing back to the 1920s, but its new position in the Nasser gov-
ernment acknowledged its social influence while auguring a
more official role
in the development of popular opinion, national identity and
civic pride.

There's no question that popular culture makes a useful
vehicle for the delivery of social and political messages. But
what's surprising about Egyptian film during this period — and
throughout its history — is the messages it delivered.
Stereotypes, particularly since 2001, have led many Westerners
to imagine Arab culture as oppressive, full of social stricture
and religious zealotry. But from the beginning, Egyptian film
portrayed a different picture.

"Mass media culture in the Arab world is secular and liberal,
sometimes to a fault," Gordon said. "My students are aghast
when I show them an Arab-language film on the first day of
class, and it turns out to be a beach party movie. Here are
Egyptian kids running around on the beach, not in bikinis, but
showing plenty of skin. You could mistake it for an Elvis movie
or Annette and Frankie."

Throughout its history, Egyptian film reflected the nation's
hunger for social progress. Stars wore Western dress and acted
out themes of forbidden love, youthful rebellion and political
farce. Screenwriters explored sensitive issues ranging from class
boundaries to the frustrations of young lovers growing up in a
sexually conservative society.

When, in 1962, Nasser pulled the film industry further under
government control, subsidizing movie budgets through the
state, the intent was not to clamp down on these frank depic-
tions but to elevate their social impact. By defraying the costs of
movie making, Nasser's regime hoped to free filmmakers from
their dependence on ticket sales and thus enable them to pro-
duce more socially conscious projects. Many directors took up
the challenge, and over the following decade, they created
films that pointed out social inequalities and criticized political
shortcomings.

In effect, Nasser's government used the cinema as a safety
valve for political unrest. State censors monitored and
approved all movies, ensuring that the criticism expressed in
films remained constructive rather than rebellious.

"It was a way of letting the public see that the government
recognized social problems, but it was also somewhat manipula-
tive. After all, entertainment is not a serious political forum,"

Gordon said. "Ultimately that sort of criticism is impotent
because the artists and directors are working within the
system. No matter how critical they are, they're still com-
plicit."

Nevertheless, the legacy of that period opened Egyptian
film to progressive themes and socially-minded plots. In
ensuing years, film production
in Egypt dropped to approxi-
mately 20 films per year, partly
due to the import of
American movies and partly to
the loss of state interest and
support. But Gordon has
noticed new filmmakers enter-
ing the industry, bringing a
new style of progressive and
realistic filmmaking.

"The Nasser era was clearly
the golden age of cinema in
Egypt, and part of that was
because the films of that era
so closely reflected the reali-
ties of society. Now we're start-
ing to see a resurgence of the industry — films produced
that reflect life as it is today, with kids hanging out, drink-
ing beer or Coca Cola," Gordon said. "There have been
conservative forces trying to ban those images, but real-
ism keeps asserting itself."

Oran, Algeria

Westward, across the Great Sand Sea and the Tunisian
Desert, another form of realistic expression developed,
roughly synchronous with the origin of Egyptian cinema.
Around the 1920s, in the colonial port of Oran, Algeria,
a new music emerged from the taverns and brothels to
be sung in the cabaret halls and the camps of migrant
workers. Its sound was plaintive and shrill, and its words
called to lost lovers, spoke of heartbreak, poverty and
drunkenness.

The expressive style of this music earned it the name
Rai, variously translated as "an opinion," "a point of view"
or "advice."

"It's hard to describe what Rai sounds like. The instru-
mentation is basic: a handheld frame drum like a tambou-
rine, a *rhab* or one-stringed violin, and maybe a reed
flute," said Ted Swedenburg, a professor of anthropology
who studies pop music in the Middle East. "What appeals
about Rai is the vocals, their powerful, sustained sound.
Even without understanding the dialect, those vocals are
compelling."

As a music of the disenfranchised, Rai recognized no
boundaries. Over the course of eight decades, it incorpo-
rated sounds from Spanish, French and Hindi music and

more recently has drawn in jazz, reggae and hip hop
influences. Its instrumentation has expanded to include
modern and electric instruments, from the accordion to
saxophone and guitar. And although women originated
the distinctive Rai vocals, some of its most popular artists
are now men. Despite these changes, the rhythms, the

secular, sensual focus of Rai's lyr-
ics and the wailing lament of its
song remain.

In a volume titled
"Displacement, Diaspora, and
Geographies of Identity,"
Swedenburg explains that, like
Egyptian films, the development
of Rai is inseparable from the
evolution of identity and politics.
Just as the Nasser regime co-opt-
ed movies to shape national iden-
tity, the Algerian state attempted
to adopt, sanitize and promote
Rai music in a bid to win popular
support. But while "cleaner" ver-
sions of Rai are now available,

the musical form, its artists, and its fans largely resisted
mainstream integration.

The social commentary of Egyptian film could be used
in support of the state because it was rooted in national
identity. In contrast, the social commentary embedded in
Rai called for a building of identity outside of religion
and state. It was the identity of the migrating, working
population, and with them it traveled outside Algeria into
France, then Europe, and recently, the United States.

**"It was the marginalized singers, often the
widows, the divorcees, the disowned, the
poor and the uprooted who invented Rai.
They created Rai from hardship and bad
luck."**

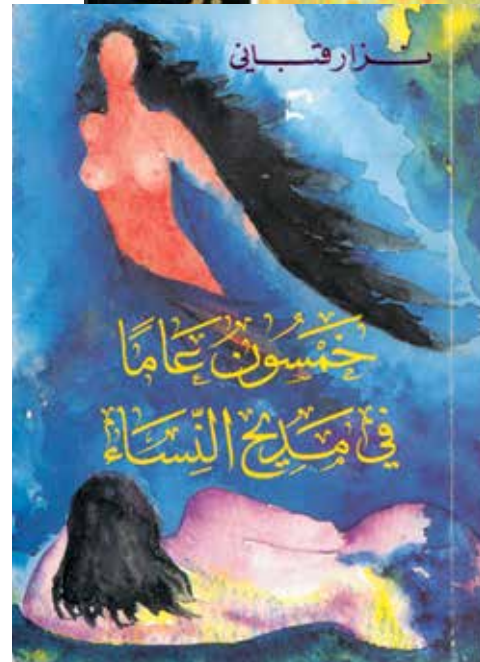
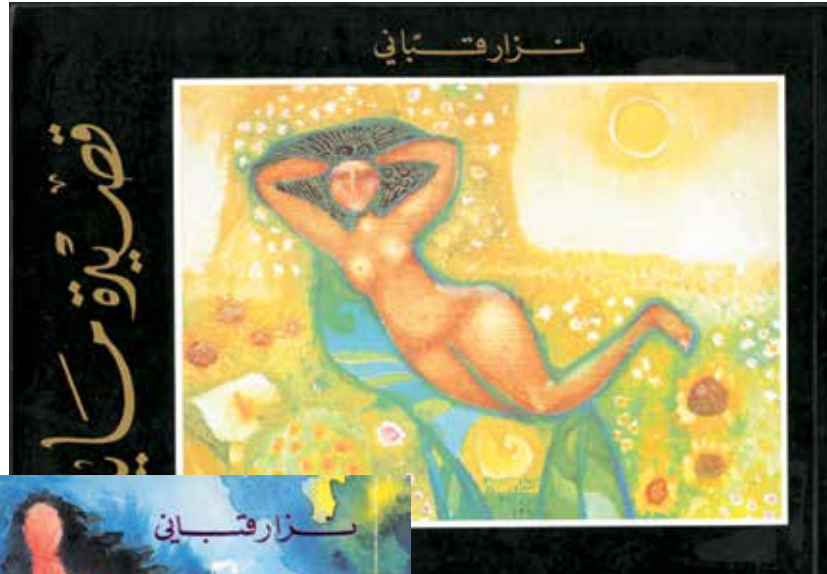
— Cheb Mami, Rai musician.



Sting (third from right) featured Rai star Cheb Mami (front, in red scarf) on the album
Brand New Day. The two toured together extensively, including performances at the 2000
Grammy Awards and the 2001 Super Bowl.

According to Swedenburg, Rai is the only form of Arab
music to have gained such a global following.

Rai's foray into the United States is relatively new, but
it's gaining exposure and support through popular
Western artists. Sting recently featured one of Rai's most



Collections of Nizar Kabbani's poetry illustrate the sensual focus of his work: top, "The Poem of Maya"; below, "Fifty Years in Praise of Women."

famous singers, Cheb Mami, on his album "Brand New Day." And although it strikes an exotic sound in the Western ear, Rai resonates with distinctly American musical forms.

Aside from shared lyrics about heartache and drink, there's a blues sensibility to Rai, Swedenburg said, and a parallel in the way the forms developed. The first decades of the blues tradition in America were marked by repetition — melodies recycled from singer to singer with new verses or lines only occasionally added.

It wasn't until blues musicians moved out of the delta towns of the South and into cities that new songs emerged. Rai originated from a similar shared tradition and remained highly formulaic until artists moved into urban centers and began adopting new sounds, new lyrics.

Rai also has been compared to rock n' roll, mainly because its frank lyrics seem to defy traditional Arab paternalism and puritanism. This "defiance" lends an air of rebellion that Western music distributors have been keen to market. Indeed, in some ways, Rai has attracted a tough and rebellious crowd of listeners.

"The 'modernity' of its musical texture and the insubordinate spirit of its messages earned pop Rai a substantial audience among a generation of disaffected and frequently unemployed youth, chafing at traditional

social constraints and the lack of economic opportunities," Swedenburg explained.

But in reality, the lyrics represent less defiance than observation, and Swedenburg argues that associating Rai with rebellion and youth misrepresents the form. In Algeria and throughout much of the Middle East, people across generations enjoy the music. It's a staple at wedding celebrations and social events as well as in night clubs and bars. What Americans mistake for rebellion is actually an acceptable and appreciated form of expression.

"The subjects that Rai addresses aren't atypical of Arab music. It's just more characteristic of the unofficial traditions in Middle East culture," Swedenburg said. "Our perceptions of

this region are under the influence of stereotypes. Rai music proves that you can't take a trend — for example, social conservatism — and assume it represents 200 million people. Culture is not homogenous throughout this region. It's extremely diverse and complicated."

Damascus, Syria

Of all the popular artforms, none is more cherished, more steeped in the culture of the Middle East, than poetry. With a 1600-year history of myth making and story telling, it records the nightmares and dreams of a vast civilization. And of all the poets who have written in Arabic, none is more widely quoted, savored, recited or shared than the Syrian-born poet Nizar Kabbani.

"Poetry is the privileged artform of the Arab world," said Mohja Kahf, an associate professor of English, herself born in Syria. "When I give talks at local high schools, I ask how many students have attended a poetry reading in the past six months. It's rare to see a hand go up. Then I ask how many have seen a sports event, how many have gone to a movie? When all the hands are raised, I tell them that's comparable to how many people would attend a poetry reading in the Arab countries. When Kabbani read, thousands of listeners came."

Kahf, whose parents brought her to the United States as an infant, was nonetheless raised hearing Kabbani's name at the dinner table, his poetry recited around her. His work was part of the atmosphere of being Arab, she said: "I breathed that poetry in at an early age." Now a scholar and poet herself, Kahf has translated many of Kabbani's works and studied his career, which spanned a 50-year period from the 1940s to his death in 1998.

The release of each new Kabbani poem amounted to a news event, Kahf said. His poems were published in Arabic newspapers, memorized by millions. It was quite a

different reception than that which heralded his first collection in 1944. Filled with sensual details and luscious depictions of women's bodies, Kabbani's early poems gained popularity among the young, who covertly passed his book to others and relished his poems on the sly.

Over the next five decades, Kabbani's work became even more risqué, but it also gained a substantial following, particularly among women. His poems reveled in the feminine form and spirit, but his work was more than wanton celebration. As it admired women's bodies and minds, it also called for their liberation. It urged women to take charge of their futures, to resist the slavery of traditional marriage. And its frank sexuality taught women to appreciate their femininity at a time when the oppressive sexual mores meant to protect them taught them, instead, to be ashamed of their bodies and impulses.

"Nothing before had been so perfectly able, as this poetry was, to narrate to woman the story of her plight, not film, not media: these were either taken as pure figments of the imagination or dubbed as foreign, not worthy of the Arab woman," explained Salma Khadra Jayyusi in an introduction to "On Entering the Sea: The Erotic and Other Poetry of Nizar Kabbani."

The form of Kabbani's messages amplified their power in a society that so revered its poetic tradition. But despite writing in a traditional form, the poet broke with tradition in subject and style. His language — idiomatic, inclusive of foreign concepts and words — gave a mellifluous, modern cadence to formal Arabic, a style that shocked some Arabs, who considered poetry a bastion of cultural purity.

While it alienated some Arab readers, Kabbani's innovative use of Arabic language also made his poetry difficult to translate, limiting its exposure to readers worldwide. Even today, only two volumes of Kabbani's work have been published in English, and those greatly abridge the poems, according to Kahf.

Kabbani's strident politics also challenged Arab tradition. Interwoven with his call for women's rights and freedom, was a call for Arab nationalism, for solidarity and cooperation among Arab nations to determine their destiny, free of imperialism or outside rule. In matters of both sex and state, Kabbani advised liberation and self-determinism. Often, the sexual and political are inextricable in Kabbani's work, Kahf said. They interchange language and metaphor, and within the aesthetics of poetry, they share a common goal — beauty.

"Aesthetics unites politics and erotics. Beauty's erotic form is love. Its political form is freedom," she said. "The premise of Kabbani's erotic poetry is that people can't attain joy in sex or love without freedom, equality and dignity. And they can't attain freedom, equality or dignity in a political system that denies those things. What you do in bed is related to what is going on in the state because the state sets the boundaries of freedom." ■

I Swear That There Is No Woman But You

(abridged)

Nizar Kabbani
Translated by Mohja Kahf

I swear that there is no woman but you
who has been as generous as the sea
with me, and as refined as poetry

I swear that there is no woman
who ever captured half the attention
you take from me
No one who has colonized me
and decolonized me,
but you

I bear witness that there is no woman but you
who manages me like a two-year-old
bringing me posies and toys and unicorn milk
—but you

I swear that there is no woman
who can say that she is all women
and that her navel
is the gravitational
center of the universe
but you

I swear that there is no woman but you
whom trees get up and follow when she strolls
at whose ponds doves drink in winter
No woman in whose armpit grasses
graze the lambs of spring, but you

I swear there is no other woman
who at her right breast time stops ticking
and from the base of her left breast revolutions rise
—but you

I swear that there is no woman but you
who shatters me in the moments of passion
like an earthquake
who scorches and drowns me,
sets me afire, puts me out
cleaves me in half like a crescent

I swear that there is no woman
who conquers and occupies me
the most blissful invasion
the longest occupation,
but you

No woman who plants me through
with Damascene roses
and orange groves and spearmint,
but you

Woman, under whose hair
I leave my questions,
and who never ever
answers a single one

Simple. Obvious. Intuitive. Impossible.

By Carolyn Garcia

Fred Davis has heard his theories characterized as all of these — by the same person, sometimes in the same sentence — by everyone from information technology professionals to CEOs. And within those competing descriptions may lie the reason that so many major technology implementations fail.

Failure rates for new information systems hover near 25 percent, with another 17 percent of projects reporting cost overruns, according to a 1999 report from Software Productivity Research. Their sample, which tracked 6,700 projects across 500 enterprises, found that as project complexity increased, failure increased. And for highly complex systems, the failure rate was 65 percent, with another 35 percent of projects experiencing cost overruns.

According to Fred Davis, who chairs the information systems department and holds the David D. Glass Chair in the Sam M. Walton College of Business, most software implementations fail because of a discrepancy between specified user requirements and actual user requirements. He points to a 2002 article in Technology Review reporting that in many instances, the purpose of new software is not spelled out before programmers begin writing it.

This lack of clarity about user requirements leads to expensive and difficult changes later in the development cycle, causing project delays, cost overruns and failure to gain user acceptance after implementation. Since this is the area that generates the costs, Davis reasoned that it would be valuable to focus on the identification, correction and prevention of these errors.

Davis is best known for development of the Technology Acceptance Model (TAM) and its extension, TAM2, which can predict if a company will be successful in implementing a new computer technology. However, his research interests also include software development practices, computer training and skills acquisition, computer-assisted decision-making and the management of emerging technologies.

The Art of Technology

Davis traces his unique perspective on technology to muralist Diego Rivera. One of Mexico's most famous artists, Rivera came to the United States in 1930 and painted a series of murals in San Francisco and New York, including the infamous Man at the Crossroads, which was commissioned and destroyed by John D. Rockefeller.

However, what many have called Rivera's greatest mural, Detroit Industry, was painted on the walls of the courtyard at the Detroit Institute of Arts (DIA). Worked on 27 panels, it depicts workers at the Ford and Chrysler assembly plants along with allusions to science and technology and the chemical and pharmaceutical industries.

As a young engineering student at Wayne State University, Davis worked on a research project in the health care industry for a

professor. He often took books and papers to read in the courtyard of the DIA, which adjoined the university campus.

"I studied Rivera's murals for hours and drew inspiration from them," said Davis. "I decided that I wanted to learn how to harness the power of technology to make good things happen."

In 1979 that research project also gave Davis his first experience in the failure of technology implementation. His part in the project was to write a complex program to schedule employees in a large hospital. Although his software worked exactly as specified, the client requested a number of rewrites and modifications. However, the client's employees never accepted the new procedures and the implementation was unsuccessful.

After earning an engineering degree from Wayne State, Davis entered the Sloan School of Management at the Massachusetts Institute of Technology. While working on his Ph.D., which would evolve into TAM, he first encountered the resistance he learned to associate with challenging "sacred assumptions."

"A major technology company was going to let me conduct my research there. They sent a helicopter for me and flew me to their headquarters for a meeting with their executives," Davis said. "They explained their project, and I pointed out why it could not succeed. By the looks on their faces, I knew that some of them

realized the problem. But the software was written, and the client was already struggling with implementation."

The software, an expert system to improve specification of the myriad parts of a major computer system, was designed to reduce costs, improve delivery and installation, enhance plant and warehouse efficiency and increase customer satisfaction. However, it provided no benefit to the sales force, which was expected to use the system.

"There was no reward at all for the sales people — no incentive to spend time learning the system or using it," said Davis. "In fact, they looked at it as a negative. It did not improve their jobs, but it took away time they could be using to make money for the company. It was not useful to them."

Because the company discontinued his project, Davis switched his research to technology implementation in the hospitality industry. The fact that he could easily switch to another failed implementation in a different industry showed Davis how pervasive the problem of technology acceptance is across all industries.

But this response no longer surprises Davis. When he was developing the TAM in the early 1980s, he often encountered skepticism. Now TAM is considered a foundation for hundreds of research projects.

Genius lies in the ability to see how two things that nobody else sees as related are related. This ability to make distant analogies unlocks a world of potential. And it's all a matter of looking for how things are the same, not for how they are different.

Fred Stratton, CEO, Briggs & Stratton

When Good Systems Go Bad

Technology development includes two types of design features — interface features and functional features. Interface features are directly associated with ease of use, and are relatively easy to modify. Functional features, on the other hand, relate to usefulness and are drawn from what the company says it requires, which makes them difficult to change.

In most software development cycles, users first see a system after it has been developed and a working prototype created. Drawing on his research into usefulness and ease of use, Davis developed a model for pre-prototype user acceptance testing that would allow developers to determine if a product would be useful before the code was written.

Dubbed the “crystal ball,” his expanded model can predict if a company will be successful in implementing a new computer technology, such as introduction of proprietary software, before a single line of code is written. In other words, it allows managers to avoid the costly development and implementation of a product that will ultimately fail.

“This approach challenges the perceived wisdom that software systems can only be evaluated from a ‘hands-on’ perspective. While this is true for ease of use, it is not true for usefulness,” said Davis. “Most people think that if it is true for one, it must be true for the other. But our research has shown that this is not the case. And no amount of ease of use will compensate for a lack of usefulness.”

The Crystal Ball

In the process of extending his TAM, Fred Davis encountered a conundrum.

“Corporate America is littered with failed information technology (IT) projects,” said Davis. “Most IT managers and business leaders have horror stories of software implementations that failed after huge investments of time and money because they were not adopted by the critical users.”

The ability to prevent this enormous waste of time and resources should be beneficial to decision-makers. And when Davis presents his model to information technology managers, business leaders, faculty members and consultants, they say it is so simple that it is obvious. But within minutes, they will also insist

that it is impossible.

Davis, it seems, has discovered that the core element essential to technology adoption — usability — is a multistable perception. For most people, a multistable perception is an interesting mental game; in information technology (IT), it may cost businesses billions of dollars.

“It is like the drawing you see in textbooks. One way you look at it, it seems to be a vase, but if you shift your perception, it seems to be two faces,” explained Davis. “You can see both versions, but not at the same time. And when you try to see both, they both disappear and you are looking at a meaningless drawing.”

Introduced by Danish psychologist Edgar Rubin in 1915, the vase/face drawing is probably the most famous example of multistable perception. It represents a puzzle that has challenged psychologists for more than a century, that something can take multiple, distinct, but mutually inconsistent forms. Most observers shift back and forth between the forms, but cannot hold awareness of both distinct forms at the same time.

“Usability seems to be like that,” Davis added. “In IT we have subsumed two constructs — usefulness and ease of use — into the concept of usability, which seems to be multistable. Usability is the most critical factor in user

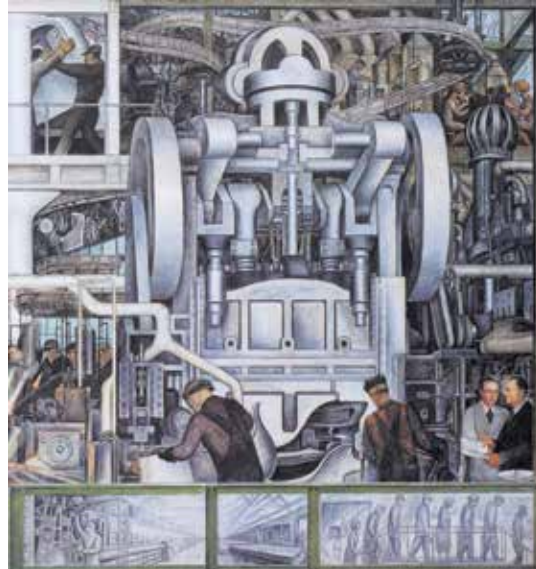
acceptance of technology, but major IT implementations still fail because only one component of usability — ease of use — is addressed.”

What Do Users Want?

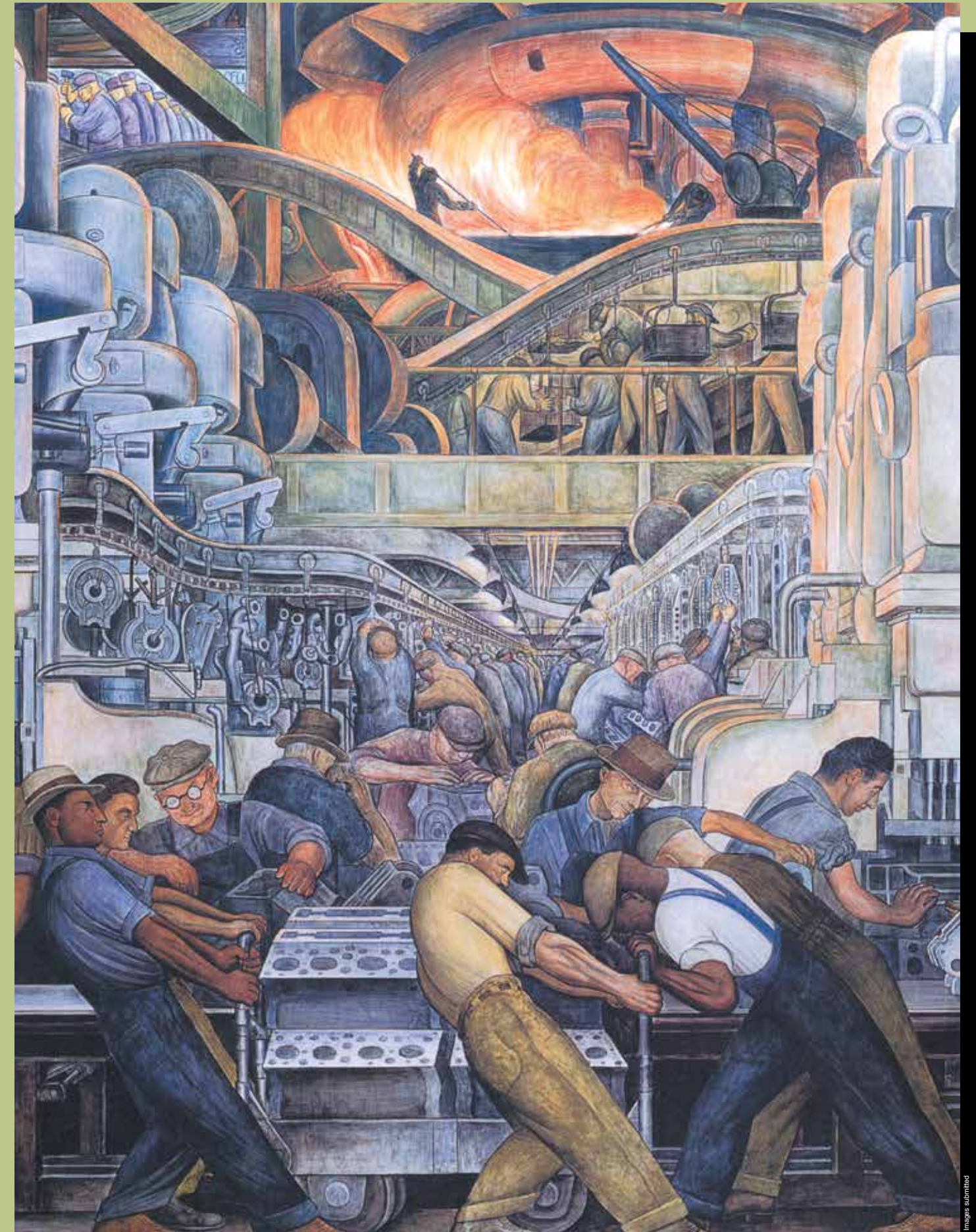
Davis has spent his career studying why users adopt — or fail to adopt — technologies. Introduced in 1986, his TAM has become central to most discussions of user acceptance. TAM showed that perceived usefulness and ease of use were the only two factors that consistently influenced user acceptance.

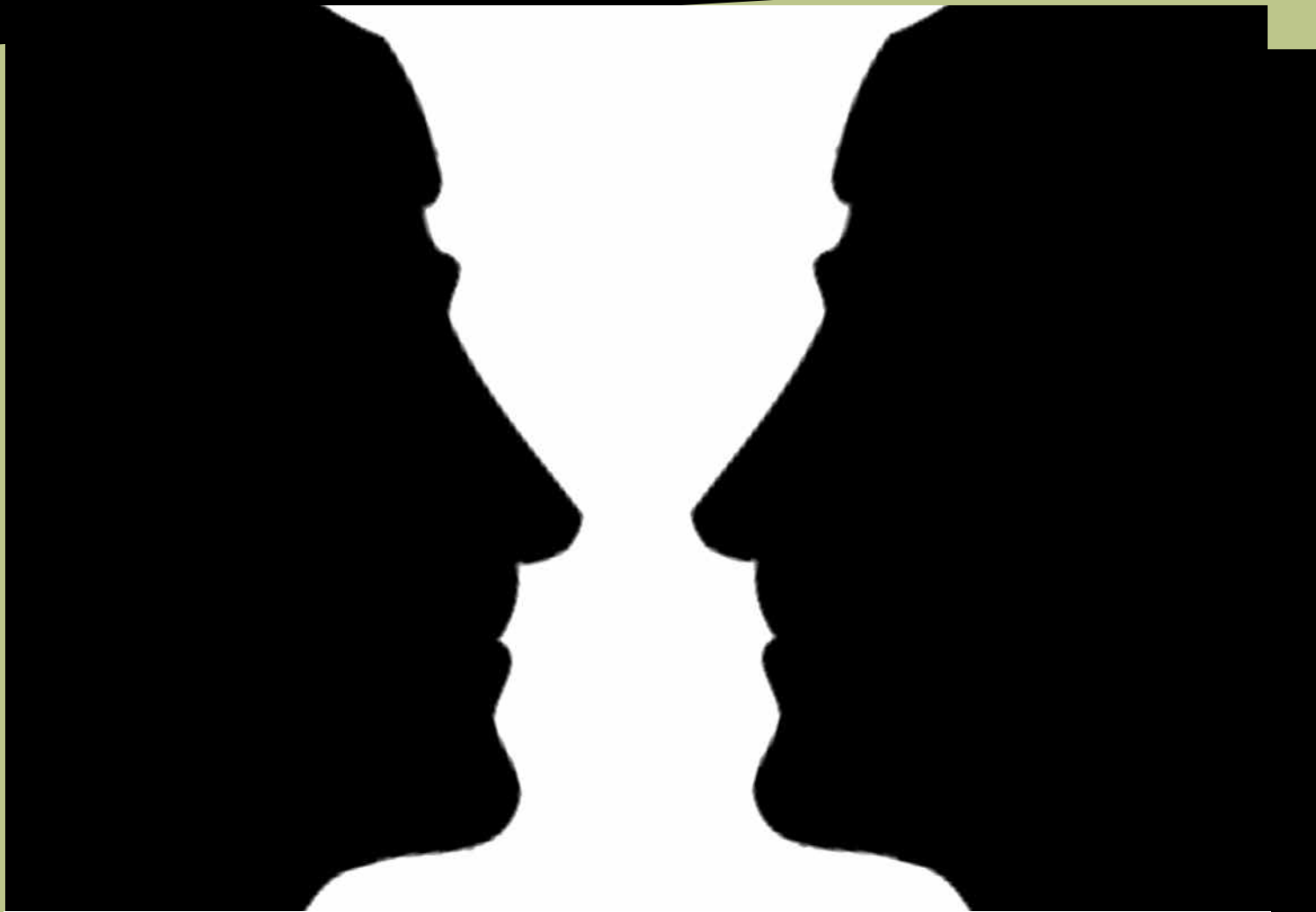
During the past decade, many studies have shown that, while both are necessary, perceived usefulness is the strongest determinant of user acceptance. If a technology is useful, the user will tolerate some difficulty to use it. But if the user doesn’t find the technology useful for his or her particular job, the implementation is likely to fail.

Because of its central role in employees’ intention to use a computer technology, Davis worked with Viswanath Venkatesh of the University of Maryland to study perceived usefulness in detail. Their research looked at social influences — voluntariness, image



Diego Rivera, detail from the south wall, Production of Automobile Exterior and Final Assembly, 1932, fresco.





and the opinion of persons important to the employee, and cognitive influences — the employees' own opinions about usefulness of the new technology in their job.

The researchers tracked the implementations of new computer technologies in four different manufacturing and financial services companies over a period of time. In two companies, the use of the technology was voluntary and in two others it was mandatory.

In studying employee opinions about the usefulness of the new technology, Davis and Venkatesh focused on job relevance, output quality, ease of use and tangible results. They found that employees are more positive toward a new technology if they think that it is directly useful to their job and performs the tasks well.

Although perceived relevance and quality are closely related, the way employees use them is different. Job relevance is used to eliminate systems from consideration that are judged to be less relevant. Output quality is used to select one system from among several options.

"Even effective systems can fail to get user acceptance because of lack of result demonstrability," explained Davis. "If users can't tie gains in their job performance directly to the use of the new

system, they are unlikely to think of it as useful."

Prior to the introduction of the technology, the opinion of other people significant to the employee had a great deal of influence, Davis found, but only if the implementation was mandatory. Even then, the importance of this element diminished over time as the employee used the new technology.

"Organizational mandates don't always have a positive effect on technology use," notes Davis. "Even when usage is mandatory, usage intentions vary because some users are unwilling to comply with such mandates."

Managerial Mandates

It seems intuitive that once a software product is developed, managers can merely order employees to use it. However, extensive research and business experiences demonstrate that this is not the case. No matter what the incentives or disincentives, managerial mandates are insufficient to ensure adoption. In fact, Davis' research showed that managerial mandates are the least effective means to achieve compliance in a technical environment.

To determine what factors influenced employee intentions to adopt a new methodology for developing software, Davis and colleagues Bill Hardgrave, director of the Information Technology Research Center, and Cynthia Riemenschneider, assistant professor of information systems, conducted a study with 128 developers in a Fortune 1000 firm implementing a new methodology that had been custom-created for the company's internal use. Implementing development methodologies has been called one of the most serious areas of concern in IT

"We expected that making the usage mandatory would increase employees' intention to comply, but it didn't," said Hardgrave. "In fact, of all of the parameters we evaluated, managerial mandate was the least likely to induce compliance."

Methodologies are comprehensive systems that standardize the steps in the development process. Although they can provide increased productivity and profitability, development methodologies are only used in about half of all companies that develop software because of the difficulties in deploying the systems.

"Many organizations are trying to improve their software development by implementing methodologies," explained Davis. "But this usually represents a substantial change from their previous practices. Developer resistance can prevent the company from fully deploying or realizing the benefits of the methodology."

Overcoming this resistance requires knowledge of the factors that make an employee intend to use the methodology. According to Hardgrave, the new methodology represented a radical change for the developers, who moved from an environment with no prescribed processes in place to an environment guided by an organization-wide methodology.

The developers were introduced to the methodology in a presentation, trained with it for six weeks and given written and online instructions. At the end of the training period, developers were instructed in writing to begin using the new policy. After 12 weeks they were given a questionnaire to assess their intention to use the new methodology on the basis of five common determinants — usefulness, compatibility with their existing practices, social pressure, complexity of the new methodology and organizational mandate.

"As we expected, complexity had little impact on intentions," Hardgrave added. "But neither did organizational mandate. The greatest influence was usefulness, followed by compatibility and social pressure."

According to Davis, these findings point to training strategies that could improve acceptance of new methodologies. Since perceived usefulness is crucial, demonstrating the individual productivity benefits of the methodology could help to address this issue. Managers also might improve adoption by explicitly demonstrating how the new methodology is compatible with existing work practices and design a migration path that will introduce parts of the methodology incrementally rather than in a single step.

Training

The importance of training in technology acceptance has led Davis to explore the ways in which training strategies impact skill acquisition. His recent work focuses on the role of symbolic mental rehearsal (SMR) as an integral component of a training program.

"Insufficient computer skills are a key reason why organizational investments in information technology so often fail to deliver the desired productivity gains," Davis said. "Improvements in computer skill training represent a key driver of ongoing productivity improvements."

Behavior modeling is a common approach to computer skill training. In this approach, trainees watch a model demonstrate computer skills and then repeat the demonstrated behaviors. This approach has proven to be more effective than approaches like computer-aided instruction, lectures or self-study. Davis speculated that the addition of SMR to traditional behavior modeling could significantly enhance learning.

"SMR is a specific form of mental rehearsal that establishes a cognitive link between visual images and symbolic memory codes," explained Davis. "In essence, trainees imagine themselves performing behaviors that they saw performed by the trainer."

Davis conducted experiments to determine if the addition of SMR would facilitate the development of knowledge structures. Knowledge structures are the rules and strategies, the "scaffolding," that guide the construction of complex behaviors like using a new software system. His research showed that SMR does more than knowledge and task performance.

"The research also showed why SMR has this positive effect on training outcomes," Davis said. "It showed that changes to relevant knowledge structures are a key mediational process by which SMR produces training improvements."

New Worlds to Conquer

Davis constructed his unique approach to understanding user acceptance of technology by drawing on theories from psychology, sociology, education and many other fields. He has demonstrated that focusing on the key elements of TAM can give employers a "crystal ball" that can be used to determine if a technology implementation will succeed before a single line of code is written. And he has demonstrated that the addition of SMR to traditional behavioral modeling can significantly enhance computer skills training and, consequently, productivity.

"Although hundreds of projects and articles have focused on TAM, it certainly has not been exhausted as a research field. For example, none of the recommended practices, have incorporated a user acceptance model," Davis said. "But I have become interested in exploring self-regulated learning strategies. I want to know if you can train people to be self-directed learners." ■

KENAF:

COMING SOON TO A STORE NEAR YOU?

By Melissa Lutz Blouin

It belongs to the hibiscus family. It grows tall like bamboo in warm climates. It can be made into yarn but has more strength than cotton. It's kenaf, and Mary Warnock has spent some time in her laboratory seeing what she can make of it. It turns out that she can make quite a lot.

Warnock, professor and director of the School of Human Environmental Sciences, has spent her career experimenting with textiles. For a time she tested textiles for Wal-Mart Stores, Inc., and eventually she helped them establish their own laboratories in Northwest Arkansas, where some of her former students now work.

More recently, she became interested in kenaf when a company asked her to bury some.

She performed burial studies and soil analyses on the kenaf in different types of soil to see how well it decomposed. Many materials used in products today — such as polypropylene — do not break down in the soil. This can be problematic if these products end up in landfills.

"They stay there forever and ever," Warnock said.

However, kenaf proved susceptible to mold and mildew, which broke down the fibers and deteriorated the material in about six weeks.

This biodegradability project piqued Warnock's interest in the fiber. Kenaf was brought to the United States from Africa in the 1800s, but it never became a valued crop. She is now working with a group of Arkansas farmers who are looking at kenaf as a potential cash crop. They have asked her to develop and test potential products that could be created using kenaf.



She has embraced the project thoroughly: She tried growing kenaf by her house. After harvesting the stalks, she puts them through a "retting" process in the back yard, letting them soak in water for a few weeks.

"True grass-roots research," she quips. After the retting process, she pulls the fibers off the stalk and boils them for 15 minutes in a 20 percent sodium hydroxide solution to get rid of the waxes, pectins and lignins that glue the fibers together. After rinsing, she has pliable fibers that can be made into products.

Warnock has a briefcase full of samples at the ready. She pulls out a piece of bark, strands of fibers, a skein of yarn made from the fiber and a small woven sample of a cotton-kenaf blend.

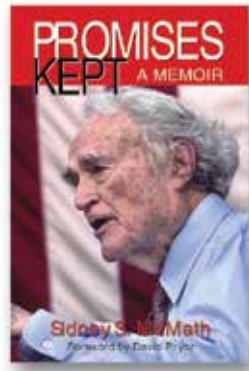
"Cotton gives comfort, kenaf gives strength," she said.

She has taken kenaf and made doll hats, doilies, knitted samples, but she has also used kenaf to make other types of craft materials. The fibers take dye well and sport brilliant colors. The dyed fibers resemble raffia, often used to decorate presents. Because of its strength, it can be used in basket making. Warnock has also taken the fibers, ground them up, and made paper from them. The paper can be plain or marbled with color.

And the fiber is not just decorative. Cows can eat kenaf. Warnock created a range cube with the hay-like fibers that the animals can munch on. Warnock also has shown that kenaf stiffens concrete mixtures, making the concrete go further, which may be useful in third world countries where resources are scarce.

Warnock concludes that kenaf may have many potential uses. And producers get paid more per acre for kenaf than for cotton. But one potential problem that remains is lack of infrastructure. Currently, very few factories can process this particular plant.

"There's a system set up for cotton. There's not a system set up for kenaf," Warnock said. ■

**Promises Kept:
A Memoir**

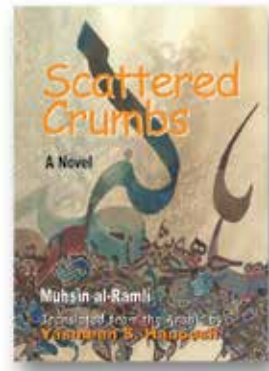
Sidney S. McMath

University of Arkansas Press

In “Promises Kept: A Memoir,” by Sidney S. McMath, the former Arkansas governor discusses his early life in rural Arkansas, his military service, his political life and his career as a lawyer. He also helped change the rules that prevented black citizens from voting in primaries, and he worked with President Truman to keep the segregationist Dixiecrats from taking over the Democratic Party — and the presidency.

In his memoir, McMath describes how he and other recent World War II veterans successfully challenged one of Arkansas’ most powerful and corrupt political machines in 1945. When he later became governor, he brought the first roads and electricity to rural areas, fought the poll tax and created the state’s first medical center. McMath also tackles the accusations of political opponents who alleged bribery in his highway program. Although no indictments were handed down, McMath’s political career ended. Arguing his case for the first time in this book, he sets the record straight.

McMath was a pivotal figure not only in Arkansas history but in the history of the Democratic Party and American law. “Promises Kept” highlights the difficult choices of real democracy as told from the crucial perspective of a man at the center of history. ■

**Scattered Crumbs
Mushin al-Ramli**

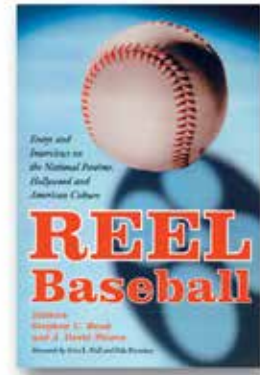
Translated by Yameen S. Hanoosh

University of Arkansas Press

In the wake of the Iraqi conflict comes a timely translation: “Scattered Crumbs,” a novel by Muhsin al-Ramli, translated from the Arabic by Yameen S. Hanoosh. Set in an Iraqi village during the Iran-Iraq war, the book tells the story of a peasant family in turmoil. The father, a fierce supporter of Saddam Hussein — here called “The Leader” — clashes with his artist son, who loves his homeland but finds himself unable to paint the leader’s portrait for his father’s wall. Hanoosh says the novel “evokes the processes of deterioration undergone both by the country and by the individual characters caught up in the maelstrom.”

“Scattered Crumbs” was first published in Arabic in Cairo in 2000. It is the winner of the Arabic Translation Award sponsored by the University of Arkansas Press and the King Fahd Center for Middle East and Islamic Studies at the University of Arkansas. The prize, designed to support and publish fine translations of important Arabic writing, awards \$5000 to the translator and \$5000 to the original author plus publication of the translation.

Hanoosh is an Iraqi-born doctoral student in Arabic language and literature at the University of Michigan. ■

**Reel Baseball**Edited by Stephen C. Wood
and J. David Pincus*McFarland & Company, Inc., Publishers*

A convergence of two great American pastimes — movies and baseball — “Reel Baseball” focuses on the ways that baseball has been used in movies as a form of cultural shorthand. As an example, author David Pincus, who teaches management in the Sam M. Walton College of Business, points to the movie “Pearl Harbor.”

“In “Pearl Harbor” there is a scene where the Japanese bombers are flying in overhead while on the ground some children are playing baseball in a park,” Pincus explained. “Of course, the attack on Pearl Harbor was at 7 a.m. on a Sunday morning, so it is not likely that literally happened. Baseball was being used as a shorthand for all things American, while the children symbolized innocence in the face of aggression.”

“Reel Baseball” comprises 18 essays, analyses by Pincus and Wood and interviews with filmmakers. The sections on baseball in non-baseball films provide new insights into the process of filmmaking and the role of baseball in American culture. The material is carefully researched and documented, but “Reel Baseball” is not a textbook; it appeals to a broad general audience.

Pincus and Wood also have developed a large filmography on baseball in non-baseball film. Spanning films from 1898 to 2002, it is available on their Web site: <http://www.ReelBaseball.net>. ■

**It Started Here:
Early Arkansas and the Louisiana Purchase**

Larry Foley

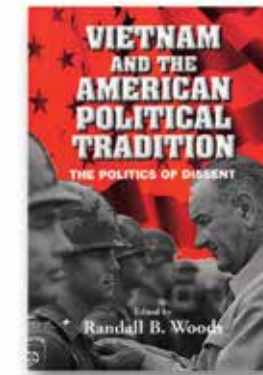
Arkansas Educational Television Network

No single acquisition of land did more to shape the United States than the Louisiana Purchase. But when Thomas Jefferson bought the land from France in 1803, the boundaries and features of the territory were largely unknown. The quest to map and measure that mysterious land began at the territory’s edge in a wilderness that would one day be known as the state of Arkansas.

Produced through a collaboration between the University, Arkansas Educational Television Network and the Arkansas Secretary of State’s Office, “It Started Here: Early Arkansas and the Louisiana Purchase” explores the history of Arkansas from 1803 to 1836, beginning with its role in surveying the Louisiana territory.

Written and directed by associate professor of journalism Larry Foley, with camerawork by alumnus Trey Marley and original music by professor James Greeson, the 30-minute documentary uses the survey as the starting point of a story that covers broad historical terrain.

The film addresses the history of the Arkansas Post, oldest settlement west of the Mississippi River, and the founding of Fort Smith, built to keep peace between two warring American Indian tribes. It touches upon the lives of the Quapaw, Osage and Cherokee Indians in Arkansas and describes the New Madrid earthquake that shook the region around 1811. ■

**Vietnam and the American Political Tradition**

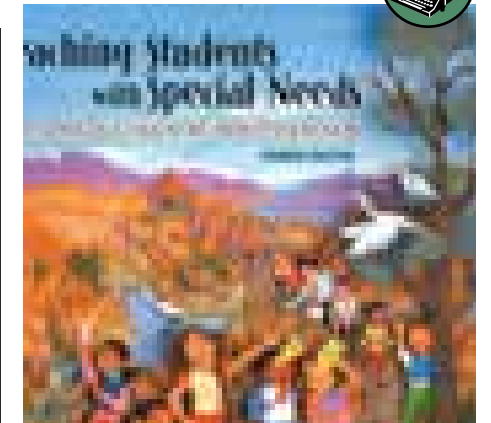
Edited by Randall B. Woods

Cambridge University Press

Despite a decade of public dissent and protests staged nationwide, it took a handful of senators to halt the war in Vietnam. A new book edited by distinguished professor of history Randall Woods examines the origins of their opposition. In the process, it suggests that challenging a president’s foreign policy can be both conscientious and patriotic — a fight for American values, rather than a betrayal of them.

Essays from leading scholars of history and political science reveal how seven U.S. senators — from different regions, backgrounds and political parties — each came to oppose the war in Vietnam. Among these loyal dissenters were Senators Ernest Gruening, George McGovern, Frank Church, J. William Fulbright, Al Gore and John Sherman Cooper. Additional chapters discuss the evolution of the war and the responses of Presidents Johnson and Nixon to their critics.

Rather than contesting the purpose of the war — halting the international spread of communism — the senators focused their opposition on its effects. Among the negative consequences they perceived were the unchecked growth of the military-industrial complex and the federal government’s disregard for American civil liberties. They felt these effects undermined the nation’s political integrity and threatened quality of life in the regions they represented. ■

**Teaching Students with
Special Needs in Inclusive Settings**By Tom E.C. Smith, Edward Polloway,
James R. Patton, and Carol A. Dowdy*Pearson Education/Allyn & Bacon*

Imagine being a new teacher and stepping into a classroom for the first time. According to the U.S. Department of Education, 20 to 30 percent of the students you face will have special needs. Whether bringing mental retardation, emotional and behavioral disorders, hearing impairment, exceptional abilities (“gifted”) or other conditions, all are there to learn to the best of their abilities.

“Teaching Students with Special Needs in Inclusive Settings” introduces 14 students with disabilities and their teachers, who put a human face on the issues, dilemmas and possibilities for all who participate in an inclusive classroom.

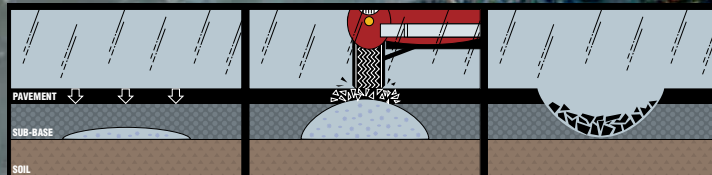
Tom E. C. Smith, head of the department of curriculum and instruction, and co-authors Edward A. Polloway of Lynchburg College, James R. Patton of University of Texas, and Carol A. Dowdy of University of Alabama at Birmingham, offer information, insight and strategies to educators who teach in a general education classroom.

The fourth edition includes increased coverage of cultural and linguistic diversity and the use of advanced technology in the classroom. By following the stories of real students, aspiring teachers are reminded of “the individuality among all students and the impact a teacher can have on their success in the classroom.” ■





Why do potholes always return to the same spots, even after they are repaired?



Above left: Water from melting snow and ice seeps into the pavement and softens it. During repeated cold spells, the water in the pavement refreezes and expands, breaking up the pavement, on and below the surface. Above middle: When the ice melts, it leaves gaps inside the pavement, and the moisture further softens it. The soft, fractured asphalt cannot support the weight of passing vehicles, and begins to break up. Above right: As vehicles continue to pass over the weakened spot, pieces of roadway are kicked out, creating the hole in the highway.

Norman Dennis, professor of civil engineering, replies:

Potholes are always related to water. Potholes often return in places where we put a “bandage” on the pavement by patching the hole, but don’t fix the real source of the problem.

In cold climates, water that seeps through joints and cracks in the asphalt collects under the pavement and freezes to form what are known as ice lenses. These lenses can become quite large, measuring up to two meters in diameter.

When the ice lenses melt, either during the heat of the day or during the spring thaw, the water drains away, leaving a void near the surface. When cars drive over the place where the void exists, the pavement collapses into the void, creating a pothole.

In the South, where the temperatures rarely stay below freezing long enough to create ice lenses, the culprit behind potholes is the soil itself. Soil beneath the asphalt gets wet and softens. The weakened soils cannot carry the wheel loads transmitted by the asphalt, so when cars and trucks drive over the road the asphalt collapses into the area of weakened soil and a pothole forms.

Fixing a pothole correctly requires getting deep under the asphalt surface and providing materials to support the asphalt that drain well like sands and gravels. This way water does not build up under the pavement.

The best way to prevent potholes from forming is to build the entire substructure of the road out of free draining material and keep the pavement surface sealed. However, both of these methods cost lots of money, so instead you will continue to see potholes appearing and being fixed in many of the same places. ■

How Do You Get A Computer Virus?

Ken Armstrong, instructor in information systems in the Sam M. Walton College of Business, replies:

Several types of viruses are now prevalent in today’s online world. They include file infectors, Trojan horses, worms, macro viruses, time bombs and many more. Viruses are programs that require a host — typically a program file — to infect a computer, and they are designed to make copies of themselves to “survive.”

The effects of viruses vary. Some take up space and spread to fill up a disk with multiple copies of themselves. Some delay computer operations and increase the likelihood of system crashes. Others alter or overwrite data. Whatever the end effect of contracting a virus, one thing is certain: Firms spend increasing amounts of time and money to deal with this problem. They pass on these costs to their customers in terms of higher prices.

Some of the common ways of contracting a virus include opening e-mail attachments, running program files that are passed around on diskettes or over a network and downloading infected files from Web sites or newsgroups.

Anti-virus software is a must on any computer with an Internet connection or one that receives files from other computers. Unfortunately, anti-virus software is only a small part of the solution. Hundreds of new viruses are written daily. To catch new viruses, update software with the latest anti-virus listing as often as possible.

Computers contain programs as well as data files. In the event of a virus, programs can be reloaded from the original disks easily enough. But if personal data files — like spreadsheets, records or manuscripts — are destroyed or overwritten by a virus, what can you do? If no other copies of these files exist, make at least one backup copy and store it somewhere offsite. ■

Got a question? Send it to UA Q & A, 800 Hotz Hall, Fayetteville, AR 72701, or send questions by e-mail to <blouin@uark.edu>.