


endeavors

Research and Creative Activity • The University of North Carolina at Chapel Hill
Fall 2011



Two-year-old Jonah Weishaar has a rare and fatal disease. There is no cure. His mother started a foundation to try to save his life. But the clock is ticking. **Why does it take so long to develop new treatments for diseases? And what can we do about it?**

page 6

endeavors

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Endeavors engages its readers in the intellectual life of the University of North Carolina at Chapel Hill by conveying the excitement of creativity, discovery, and the rigors and risks of the quest for new knowledge.

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On the cover: Left to right: Jeremy Weishaar, Jonah Weishaar, and Jill Wood. Photo by Dodi Holm.

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The magazine you are holding is soon to be no more. We will no longer be able to print it. You may not be surprised to find out why: budget cuts. UNC-Chapel Hill's overall permanent cut in state appropriations totals more than \$100 million. Those cuts trickled down to us at *Endeavors*, and I had to choose between printing a magazine or laying off staff.

When it loses *Endeavors*, the university will lose the public support, understanding, revenue, and goodwill generated by the 40,000 copies we have mailed three times a year to life members of the General Alumni Association, to all UNC-Chapel Hill faculty and many professional research staff, to UNC trustees and other official boards and advisory groups, to legislators and public officials, to funding agencies, and to the media. And the loss of *Endeavors* is just one of the effects the budget cuts will have on research at UNC-Chapel Hill.

We created, printed, and mailed *Endeavors* on a relatively small budget—in fact, we did it for less than half of the national average per-issue cost of university research magazines—and I'm proud of that. We did it all in-house, with a very small staff. But the Little Magazine that Could now can't.

You might notice that this issue is quite a bit thinner than you're used to. For this issue and for our final issue, we're cutting back from forty-eight to thirty-two pages to save a bit of money.

At *Endeavors* we've always tried to tell stories: to show in compelling ways how the research and creative activity at UNC makes the world better. If I had to tell the story of *Endeavors*, it might go something like this: *despite the odds, a plucky little research magazine thrives, becomes well-known and well-respected, wins national awards for writing and design, all on a shoestring budget and all because the people who make it love what they do...* We printed this magazine for over twenty-seven years. We kind of liked it. I'd like to think that some of you did, too.

But let me express my gratitude to you for reading *Endeavors* over the years. Thanks for being part of our story.

We'll continue to publish at our website, endeavors.unc.edu.

If you'd like to comment, or if you have any questions, you may reach me at 919-962-7765 or at jdsmith@email.unc.edu.

—Jason Smith

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UNC
RESEARCH

contents



Blue crabs packed for shipping by H.M. Arnold. Photo by Bernie Herman. Story on page 12.

2 OVERVIEW

- Cherokee: hitting the jackpot?
- An immune switch
- Bad air days
- You'll see stars

4 FACULTY PROFILE

Off-trail, on target

COVER STORY

6 Heartbreak Hill

The race for new treatments and cures has more in common with a marathon than with a quick 5K. What can we do to make it shorter?

by Marla Vácek Broadfoot

FEATURES

12 A Mouth for the South

Bloody butcher corn, slick dumplings, clam fritters, and drum head stew: they're what's for dinner in Delmarva.

by Susan Hardy

16 Father and the Führer's War

Historian Konrad Jarausch wanted no part of his family's past. But a briefcase full of wartime letters introduced him to the father he never knew.

by Mark Derewicz

THREE STORIES ABOUT UNDERGRADUATE RESEARCH

20 The Fog of Chronic Pain

Playing a musical instrument might help you cope with the worst of a debilitating condition.

by Mark Derewicz

22 Devil Down in Hill Country

Reed Turchi goes to north Mississippi to work with some of the best blues musicians you've never heard.

by Margarite Nathe

24 Portrait of a Village

Jobs and workers are trickling away from the tiny Turkish town of Esenler. Who's left behind?

by Margarite Nathe

30 IN PRINT

- Mississippi burning
- Yosemite rocks
- Who really wrote the Good Book?

33 ENDVIEW

Moonlighting.

overview

ECONOMIC DEVELOPMENT

Cherokee casino: hitting the jackpot?

by Mark Derewicz

From 1997 to 2011, Harrah's Cherokee Casino evolved from a simple bingo operation into a huge resort with three hotels, a conference center, a 3,000-seat event center, retail shops, restaurants, and vast areas dedicated to gambling. The Eastern Band of Cherokees has been the direct beneficiary of the casino's revenues, but no one had measured the wider economic benefit to the region until James Johnson, Jack Kasarda, and Stephen Appold figured it out. They analyzed census data, economic and employment reports, financial statements, and health statistics to determine the casino's impact.

Here are a few of their findings:

- In 2010, the casino's revenue, which is shared among tribe members, totaled \$386 million.
- Two-thirds of that revenue comes from out-of-state visitors.
- In 2009, casino revenue infused the local economy with about \$300 million.
- In 2009, casino spending on wages and vendor purchases added more than \$65 million into the local economy.
- From the mid-1990s to 2010, the resort boosted the region's per-capita income from 70 percent of the state average to 80 percent.
- The region's historically high unemployment rates are now commensurate with the state average.

Though the available evidence points toward a substantial improvement in regional well-being, Johnson says, "the casino has not solved all regional economic and social problems. While life expectancy, poverty rates, and educational attainment have improved, high-school completion rates and



enrollment of Cherokee students in the UNC system remain lower than in other regions."

James H. Johnson is the director of the Urban Investment Strategies Center at the Kenan-Flagler Business School. John D. Kasarda is the director of the Frank Hawkins Kenan Institute of Private Enterprise, and Steve J. Appold is the senior research associate at the institute. See their report at bit.ly/lh3QTN.

MICROBIOLOGY

An immune switch

by Beth Mole

Our bodies' first defense against invading bacteria and viruses is our innate immune system—the indiscriminating trigger for inflammation, for the drafting of assassin immune cells, and for cascading chemical signals that work to wash away intruders. Without it, we'd be goners. But if the system is on too long, we're plagued with autoimmune disorders and chronic inflammation. In a new study, Carolina researchers found evidence of a shutoff switch—a protein called NLRX1.

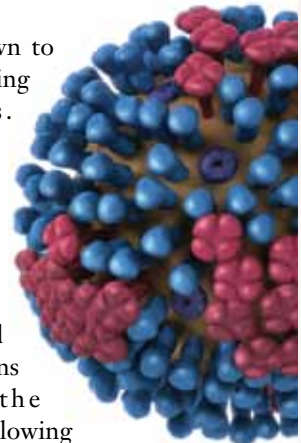
"We knew that proteins called NLRs control the immune system's initial response to an invading pathogen," Irving Allen says. NLRs can activate the innate immune system by recognizing pathogens based on unique patterns. For example, many bacteria contain the cell wall component meso-diaminopimelic acid, and the immune system cues in on it. Patterns and pattern-recognizing proteins such as NLRs allow the innate immune system to mount a quick response without having to recognize exactly which bacterium or virus has invaded the body.

NLRX1 was known to be unusual for blocking immune signals.

But Allen and fellow researchers went further to demonstrate that it blocks antiviral and pro-inflammation signals. "We found that NLRX1 functions in controlling the immune response following H1N1 influenza virus infection," Allen says. Mice that didn't have NLRX1 could clear viruses from their lungs better than normal mice, yet showed more signs of disease, presumably from a hyperactive immune response. NLRX1, Allen says, brings the overactive immune response back under control when the invading pathogen is gone.

Beth Mole was a postdoctoral research associate in the Eshelman School of Pharmacy until the summer of 2011. She's now studying science communication at the University of California, Santa Cruz.

*Irving Allen is a postdoctoral fellow in the Department of Microbiology and Immunology in the School of Medicine, working in the laboratory of Jenny Ting. Their study of NLRX1 was published in *Immunity*. Funding came from the National Institutes of Health.*



VIRUS: CDC

CAROLINA FINDINGS

It's not just your diet: our hips get wider as we age in part because the bones of the pelvis continue to grow.

Infants perceived as fussy are more likely to receive solid foods too early. Fewer than one in ten children with asthma use traditional inhalers correctly. A drug

that is commonly used to prevent organ transplantation rejection inhibits breast cancer growth in preclinical studies. Nearly one in five young adults in the United



Atlanta cleaned up its air for the 1996 Olympics. But today, the American Lung Association says the city's ozone levels make it one of the nation's twenty-five most polluted metropolitan areas.

ENVIRONMENTAL MEDICINE

Bad air days

by Mark Derewicz

The brownish haze enshrouding Atlanta concerned Olympic officials so much in 1996 that the city altered traffic patterns to limit car exhaust. It worked. The dirty air—especially ozone, the toxic mix of pollutants and sunlight near the earth's surface—diminished even as temperatures and humidity remained high. Atlanta hospitals reported far fewer respiratory-related emergency room visits. “But after the Olympics, when traffic patterns returned to normal, ozone levels shot back up,” David Peden says. “So did respiratory-related trips to the ER.”

Back then the national standard for ozone in the air was .12 parts per million. Any amount above that would warrant an orange air day—unhealthy for sensitive groups such as the elderly or people with asthma. In 1997 the EPA lowered the standard to .086 parts per million. Today it's .075. But now Peden's research shows that even .06 parts per million isn't safe, especially for people with asthma. Should the EPA change the threshold again?

Peden and his collaborators set up an experiment for fifty-nine volunteers. Each person spent six-and-a-half hours in an airtight, stainless-steel chamber on two

separate occasions. For the control session, Peden filled the chamber with clean air. For the second session, he pumped in air that had an ozone level of .06 parts per million. During each session, participants could watch television, read, check e-mail, and take a lunch break. Each person was required to walk on a treadmill—fifteen minutes on, fifteen minutes off—to mimic moderate outdoor work. Peden points out that the dose of ozone you inhale depends on how much ozone is in the air, how long you're exposed to it, and how heavily you breathe. “So we tried to control for those things,” he says.

Throughout each session, Peden's team used standard tests to check how well each participant was breathing. The next morning, each person inhaled nebulized salt water to loosen mucus so researchers could collect sputum samples.

The researchers found that even at .06 parts per million, the exhalation tests showed that people couldn't breathe as well as they could during the filtered air control sessions, though subjects didn't notice much of a change. The sputum samples were more revealing. After the .06 sessions, most subjects had inflamed airways; their mucus was filled with neutrophils—white blood cells whose primary purpose is to kill bacteria. In this case, the neutrophil response was harmful, Peden says, because

there were no bacteria to attack. Instead, the neutrophils caused inflammation. “We see that same response when asthmatics get colds or infections,” he says. “We're confident that if .06 parts per million causes inflammation in healthy people, then it would cause worse inflammation in asthmatics.”

Peden says that respiratory inflammation exacerbates allergic reactions, too. If, for instance, you're allergic to grass pollen and you spend a lot of time outside on a bad ozone day, then your allergic reaction will be worse than normal. “This is a big deal, especially for asthmatics,” Peden says. “It's inflammation that drives some people to have bad asthma attacks—coughing, wheezing, labored breathing.”

Peden can't say how many asthma patients are hospitalized because of ozone exposure during a given summer month. “But I can tell you that when there's a bad ozone day, there are a lot more respiratory-related visits to the ER,” he says. “Even at levels as low as .06 parts per million.”

David Peden is the director of the UNC Center for Environmental Medicine, Asthma, and Lung Biology. The study was co-led by EPA scientists David Diaz-Sanchez and Bob Devlin, and UNC's Neil Alexis, associate professor of pediatrics in the School of Medicine. Funding came from the EPA and the National Institute of Environmental Health Sciences.

States has high blood pressure. **Early antiretroviral treatment prevents HIV transmission.** Rats that eat snack foods commonly consumed by children and adults in

the United States eat more, gain more weight, have more tissue inflammation, and show more warning signs of diabetes than rats whose diets are high-fat from lard.

A wildfire fueled by peat that burned for weeks in North Carolina resulted in a 37 percent increase in emergency room visits for people with symptoms of heart failure.

You'll see stars

by Kelly Izlar

With a few clicks of his mouse, astronomer Dan Reichart operates a telescope that's five thousand miles away. In his Chapel Hill office, a projector screen displays a cluster of telescopes on a sunny mountaintop fifty miles west of La Serena, Chile.

Reichart and his team of software engineers have spent much of the past eight years developing Skynet, a network of robotic telescopes around the world programmed to take observations while astronomers sleep.

"Now we'll open the dome," he says, typing a few strokes on his laptop. The telescope's microphone pipes a mechanical whirring sound into the dimly lit office, and the dome on the screen slits down its center and folds open.

"Can you hear the wind?" Reichart asks.

For now, there are eleven telescopes in the network, but Reichart says this number will increase over the next year. The team is

Dan Reichart's goal is for the Skynet robotic telescope network to be open to anyone with the internet and the interest.



Your intrepid author used the Skynet robotic telescope network to capture this image of the Orion Nebula.

building two more telescopes at the Chilean site and four more in Australia.

Reichart and his team wrote the software that remotely controls the telescopes. Users log in and place observational "orders" on the Skynet web interface. When they wake up in the morning, they will have images and data from telescopes on the other side of the world.

This is an attractive option for astronomers, especially if they're based in areas with poor visibility. Too much light pollution in Chapel Hill? No problem. Try one of the Chilean telescopes. If it's daytime in Chile, it's dark in Italy. Greater geographic coverage makes it more likely an astronomer will find good observing conditions.

But professional astronomers are not the only ones on Skynet. Since its launch in 2005, more than twenty thousand elementary and high-school students have used the system. The Morehead Planetarium and Science Center featured Skynet in its Zoom In exhibit, and astronomy students at twelve universities access Skynet on a regular basis.

Reichart's team is still figuring out the best ways to include the general public, but the goal is for Skynet to be open to anyone with the internet and the interest. "People of all ages can get excited about astronomy," Reichart says. "But it is the most difficult science to access. The simplest equipment is still expensive." His vision is to build a system that not only helps researchers but also opens exploration of the heavens to everyone.

Kelly Izlar is a graduate student in the School of Journalism and Mass Communication.

Dan Reichart is a Bowman and Gordon Gray Associate Professor in the Department of Physics and Astronomy in the College of Arts and Sciences.

Off-trail, on target

by Beth Mole

I first met Corbin Jones when I was working on my PhD. On his way to talk to my advisor about one of their many collaborative projects, he would blithely bound through the lab, filling the room with his presence, ribbing bystanders along the way and teasing me about eating Cheerios for lunch. I wasn't at all surprised when he revealed that he had instituted tie-wearing Tuesdays as a student at an über-liberal liberal arts college. But I was surprised when he told me that his scientific career had started when he was a computer programmer lost on a hike.

It was May of 1993 when Jones, then a programmer in Seattle, visited Arizona's Mogollon Rim, the ledge between the Colorado Plateau and the basin and range region. On its sharp, two-thousand-foot-drop escarpments, disparate flora and fauna converge: the top of the Rim looks like the Rocky Mountains but the bottom looks like Mexico. Despite the dry, ninety-degree heat, Jones decided to go on a hike. ("Why not?" he thought.)

After one wrong turn, though, he noticed that the trees had changed. "There was a shift from Ponderosa pines to firs," he says. He was lost. While he righted his path, questions cropped up in his mind about the plants that could live on such an edge. *How did they adapt to live there? How is their genetic makeup different?* It was the first time he questioned how anything had evolved. Those questions now shape his research.

When he got back to Seattle, he found himself in a dark office, surrounded by computers. "I was looking out my door, through my boss's glass door, out through her window, and it was raining and dreary," Jones says. "I thought, 'I just don't want to do this anymore.'" Instead, he thought about working as a biologist back on the Rim, catching butterflies with a giant net.

Two years later he was in graduate school, staring out windows again, and rethinking his new plan. He had taken his qualifying exam—a dissertation proposal and knowledge exam. He sailed through the

Acute hepatitis A evades the human immune system more effectively than hepatitis C. Having a history of abuse or eating disorders may increase a woman's risk

for developing depression during and after pregnancy. Transplantation of adult stem cells enriched with a bone-regenerating hormone can help mend bone

fractures that are not healing properly. The healthiest senior citizens get the most benefit from colon cancer screening, but for less-healthy people the burdens of



Years ago, when he was a computer programmer, Corbin Jones got lost on a hike. He found his way into a career as an evolutionary biologist. Photo by Donn Young.

proposal. “I was almost feeling cocky,” Jones says. “Then came the general knowledge section, and I got beat up.” A computer background and a BA in political science weren’t much help for a general science exam. While his committee decided his fate, Jones wandered down the hall, through a glass door, and stood outside what would be his future lab. “Looking back at the exam room through the glass, I was thinking, ‘Well, I better blow the dust off the ol’ computer résumé,’” Jones says.

The moment he got back to the exam room, a committee member stepped out: “Congratulations. You passed.”

For his dissertation, Jones joined a classical evolutionary genetics lab working on fruit flies. “I went in saying I’d work on almost any system, but not on flies,” Jones says. “I thought they were gross. Turns out they’re really cute.” Jones started studying how an exotic fruit fly from the Seychelles (a small archipelago above Madagascar) can eat *Morinda* fruit, which is normally toxic. He mapped out the genes responsible.

Although his project was a success, he still wasn’t sure he was on the right path. When he moved on to his postdoc in 2000, he

made his first pact with himself: “I’m going to give science one more year, and if I don’t like it, I’m going to get a job in the software industry.” He picked his postdoc advisor, population geneticist David Begun, partly on the recommendation of one of his advisors, but mostly on personality. After his trial year, Jones was hooked. He loved it. “We

tend to think success in science is all about the science,” Jones says. “It’s not. It’s about how you work with someone, how you learn from them, how you teach each other.” He even started using his

—Corbin Jones

computer programming background, which he’d been avoiding since Seattle, to answer evolutionary questions.

When he joined the UNC faculty in 2004, Jones was still working on the projects he had started with Begun, and then he started working more on the genetics of evolution. “My lab focuses on about a half dozen different things,” Jones says. “If you consider that focused.” One is how and why new genes form—genes that evolve out of stretches of previously meaningless As, Gs, Ts, and Cs in the spaces between other genes. “We were among the first ones to

find any evidence of these in eukaryotes,” Jones says. “And now there’s more and more evidence that genomes are creating new genes—I don’t want to say out of thin air, but out of thin DNA—fairly regularly, about every few million years.”

His path hadn’t taken him back to the Rim or away from computers as he first envisioned back in Seattle, so he made a second pact with himself: he can go down as many paths as he’d like, but he has to use the skills he already has to do it. “I can take the knowledge I have to analyze large genomic data sets and use molecular biology to address our evolutionary and ecological questions,” Jones says. “I can’t just drop it all and chase butterflies.”

When I asked him what’s next, I expected an energetic spiel on computational genomics. He instead announced he was going to be a father. “And, while doing some early childhood development work, I’m going to try to do more math and stats. I enjoy learning about it. Who knows, it may pay off.”

Corbin Jones is an associate professor in the Department of Biology in the College of Arts and Sciences, a member of the Carolina Center for Genome Sciences, the faculty director of the UNC High Throughput Sequencing Facility, and now the proud father of a baby girl.

screening may outweigh the benefits. Thirty percent of North Carolina mothers of children less than two years old say they have spanked their children in the

past year. Patients with stroke-like symptoms get brain scans faster when they arrive at the hospital by ambulance than when they use a taxi or private car.

Outdoor workers who wore clothes treated with a long-lasting insect repellent had 93 percent fewer tick attachments than workers who used spray repellents.



When her son Jonah was diagnosed with a rare and incurable disease, stay-at-home mom Jill Wood was forced to become a dynamo for research and patient advocacy: "I feel morally responsible for helping the next generation of Sanfilippo Type C kids, in the hopes that in the future we can have a newborn screening test and a valid treatment, so these kids can get diagnosed and treated immediately." Here, Wood kisses Jonah while her husband Jeremy Weishaar looks on. Photo by Dodi Holm.



HEART- BREAK HILL

Why does it take so long to develop new treatments for diseases? And what can we do about it?

by Marla Vacek Broadfoot

In May 2010, stay-at-home mom Jill Wood learned that her two-year-old son Jonah had an extremely rare and fatal genetic disease called Sanfilippo Type C. For weeks, she was afraid to Google the illness because she'd been warned that would only upset her more. When she finally did, it confirmed her worst fears: a missing enzyme would allow toxic waste products to build up in Jonah's brain, eventually robbing him of the ability to walk, talk, and see. There is no cure for Sanfilippo syndrome, and the only available treatment—cord blood transplant—carries a 20 percent mortality rate.

Devastated, Wood got into the shower and cried uncontrollably. Then, as she described it, she had an epiphany: she would start a foundation, she would find other options, she would save Jonah's life.

"Once I accepted it, which didn't take long, I realized Jonah was going to die if I didn't do something about it," Wood says. "What else was I supposed to do, stick my head in the sand? Sit around and cry? I don't have time for that. I will cry—we have all done a lot of crying, of course—but I will cry when we don't have a cure, and Jonah suffers brain damage. Right now, the clock is ticking."



"Our mission is to lay the groundwork to entice researchers and drug companies to take this project on," Jill Wood says. "If we have created a patient population, if we have gotten our natural-history study done, and if we have paid for our mouse model, researchers may say, 'Oh, this is an easy project; they've done all this work for us.'" Photo by Dodi Holm.

42,000 steps

Jill Wood and Jonah are in a race they never wanted to run. All too often, as research scientists try to turn discoveries into new treatments and cures, they feel like they're running up Heartbreak Hill—a section of the Boston Marathon known for sapping runners of their energy and filling their legs with lead. Unfortunately, the race for new treatments and cures has more in common with the 42,000 steps in the Boston Marathon than with a quick neighborhood 5K.

Only 14 percent of medical research findings turn into beneficial clinical changes. And it can take up to seventeen years to turn a discovery into a treatment—a stretch of time some researchers call the valley of death. Few scientists attempt to cross it, and even fewer succeed.

"Under the best-case scenario, we can expect to have only one clinically relevant discovery in our whole lifetime as scientists," says cardiologist Cam Patterson. "If we're

going to deal with the big problems we have in health care, like heart disease, cancer, and stroke, we've got to get out of this snail's-pace approach to bringing discoveries to the bedside. Fortunately, we're beginning to understand and address some of the hurdles that slow us down."

Each researcher runs only a small portion of the race from bench to bedside, and there's not always someone to pass the baton to. Many promising discoveries slow to a halt or fall off course. "Let's admit it, sometimes we as researchers can get in a rut," says John Buse, who directs the UNC Diabetes Center. "I spend my time doing clinical trials for diabetes. If I moved a little bit off of the reservation, I would definitely need help taking that next step."

Buse is part of a new movement to help science keep on pace through translational research, an effort to get basic medical findings into practice more quickly and efficiently. The goal is to transform the way biomedical research is done so scientists can

more easily take their breakthroughs to the finish line.

The National Institutes of Health has funded a consortium of sixty universities and medical centers, including UNC's NC Translational and Clinical Sciences (NC TraCS) Institute, to the tune of \$500 million. That money will give scientists training and infrastructure to pursue new methods to treat disease.

And they're off

To get in the race, a scientist first needs a great idea. For surgical oncologist Nancy Klauber-DeMore, that idea came from wondering why the drug Avastin wasn't killing tumors in her breast cancer patients like it was supposed to. The drug thwarts a molecule that stimulates the production of blood vessels that supply oxygen and nutrients to tumor cells. Yet only about one-third of patients respond to the drug, and of those who respond, almost all ultimately die from their cancer. (The FDA proposed withdraw-

ing Avastin as a treatment for metastatic breast cancer in December 2010.)

DeMore thought the tumors might be bypassing the drug-induced roadblock and getting blood supplies through another route. So she looked for a gene she could manipulate to eliminate those alternative routes and stop the tumors from growing.

Almost immediately, DeMore encountered a roadblock of her own. The NIH rejected her grant application: her proposal was “not technically possible.” So she got funding from private foundations to develop the technique herself, dissecting microscopic blood vessels from normal and cancerous breast tissue and using gene-chip technology to look for genetic differences between the two types. That took three years.

“Of course I would want it to go faster,” she says. “Everyone would want it to go faster. But I think when you’re doing drug discovery, and you’re trying something that has never been technically possible, it’s going to take time.”

Next, DeMore generated a list of one thousand genes that could be drug targets, eventually placing all her bets on one called SFRP2. It took one year to prove that her star gene played a role in making new blood vessels, followed by another year to generate a molecular compound to block the gene in tumors, and six more months of animal testing. Now DeMore must modify the drug for human use before the biggest challenges yet: Phase I, II, and III clinical trials, which could take another nine years. If those succeed, she hopes to get FDA approval for her drug.

At every step along the way, DeMore must find more money. It takes data to get funding—but it also takes funding to get data. So NC TraCS and other institutions have created pilot awards to help scientists generate the data they need to get bigger grants more quickly and keep their projects on pace.

“The way the system is built, it can be a lot of hurry up and wait,” DeMore says. “There was a year when I’d finished my two NIH R01 grants and hadn’t gotten my next one yet, and a TraCS grant allowed me to continue my experiments and not have any delay in the science. It made a huge difference for my research.”

More hurdles ahead

Getting funding more quickly and easily is one way to accelerate research, but throwing

more money at the problem won’t necessarily get medicines onto shelves faster. The NIH doles out \$31 billion annually to support biomedical research. That’s more than double what it averaged each year in the 1990s. Yet the FDA approved only seventy-four new drugs from 2006 to 2009—half the number the agency approved in a comparable period a decade earlier.

There are other obstacles on the road to completing the marathon. Buse thinks basic scientists sometimes don’t consider the clinical implications of their research.

“We’re trying to get the basic scientists to come up for air from their benchtops, to talk to people in TraCS about what they’re working on and whether it’s something that is applicable to human health. And, if so, to get help moving it forward,” says Buse, who serves on NC TraCS’s steering committee. Howard McLeod, who has spent years researching the genomics of the body’s response to drugs, thinks another part of the problem lies in the link with clinicians. Doctors can be hesitant to leave the safety of standard treatments behind and explore new ways of treating patients, he says.

“To get things moving faster, we really have to create a new metric of success,” says McLeod, who’s one of many investigators helping to lead NC TraCS. “In the past, a lot of the extremely basic science has been done and published, and then you just hope someone accidentally does something with it. We can do better.”

One basic researcher who hadn’t considered translating her findings was Carol Otey—until she got an unexpected call from a clinician at the University of Washington (*see Endeavors, Winter 2011, “Cold Called”*). Teri Brentnall had found that some of her pancreatic cancer patients carried a mutation in a gene Otey had discovered. The two researchers figured out that having too much palladin, a protein that gives cells their shape, can cause cells to become contractile and stiff, boring channels through neighboring tissue and allowing cancer to metastasize and spread. After collaborating for seven years, Otey, Brentnall, and cancer surgeon

H.J. Kim showed how palladin might be useful as a biomarker to spot early-stage pancreatic cancer, a type of cancer that often isn’t diagnosed until it’s too advanced to treat.

Hitting Heartbreak Hill

People facing life-threatening illnesses are among the most impatient for such breakthroughs. Jill Wood’s son Jonah may not survive the ten years it can take for a new treatment to traverse the FDA approval process. So his best chance is to enroll in a clinical trial.

But this is the spot where most scientists hit Heartbreak Hill.

Only 14 percent of clinical trials reach recruitment goals on time. That’s partly because it takes between 5,300 and 5,600 patients to get enough data to file for a new drug application with the FDA, and partly because there are about 100,000 clinical

trials already in existence. UNC has one of only three Clinical and Translational Science Award sites in the country with an office dedicated to helping researchers identify, recruit, and retain the research participants they need to complete their clinical trials.

The Research Recruitment Office at

UNC has helped more than fifty investigators, including clinical psychology doctoral student Carlye Kincaid, who tests the benefits of smartphone technology in supporting a parenting skills program. The Carolina Data Warehouse for Health, a repository of data on 1.8 million potential research subjects, helped Kincaid find the best participants for the study. Though Kincaid’s study is cruising along, other researchers continue to face challenges. Ken Ataga, for one, has been involved in a number of clinical trials for sickle cell disease, but these have yet to produce any new treatments.

“Because I’m more of a clinical researcher, new drugs don’t get to me until they’ve gone through all types of preclinical testing in petri dishes and animals,” Ataga says. “And not many drugs have crossed that barrier from preclinical to clinical. There have been a few, but not as many as I would want.”

“To get things moving faster, we really have to create a new metric of success. In the past, a lot of the extremely basic science has been done and published, and then you just hope someone accidentally does something with it. We can do better.”

—Howard McLeod,
pharmacogenomics

Ataga was the lead investigator on a trial of an experimental drug that keeps the red blood cells of sickle cell patients well hydrated, under the hypothesis that the cells would be less likely to clump up and cause the painful, debilitating episodes that most patients experience. He saw the drug through promising results from Phase I and II trials, eventually presenting the results at a national hematology meeting. But then the trial's Data and Safety Monitoring Board halted the Phase III study when it determined that the drug didn't significantly decrease patients' pain episodes.

"It was very disappointing," Ataga says. "To go from the start to the end was very exciting, but unfortunately it didn't pan out the way we had hoped. It's a complicated disease, and unless we do the trial, we don't know what's going to work and what isn't going to work. So we just have to keep trying."

The final steps

The FDA was created to protect public health, so safety—not speed—is its top priority. But some researchers think the agency's many restrictions may be doing patients more harm than good.

In 2010, an independent science board reviewing the FDA concluded that American lives are at risk because "while the world of drug discovery and development has undergone revolutionary change—shifting from cellular to molecular and gene-based approaches—the FDA's evaluation methods have remained largely unchanged over the last half-century."

The FDA responded with initiatives to change the way it reviews science and technology breakthroughs. The most recent of these is a plan to scientifically dissect the FDA's methods and procedures and modernize them to ensure that effective products aren't stuck in the pipeline.

UNC hematologist Thomas Fischer has sent many products into that pipeline. One of his inventions, a glass-laced bandage that stops bleeding two times faster than cotton ones, has been approved for both military and civilian applications.

"I haven't hit on some of the horror stories you often hear about," Fischer says. "The FDA has been very good to me. But I do know what the back door of the FDA looks like—that's where I usually end up. But they're very polite about it."



"When we got this diagnosis, I asked our neurologist if this was a death sentence," Jill Wood says. "She looked away and she sat there for so long, and I thought, 'Oh no, it is. She's trying to collect her thoughts here.' And she came back and she said, 'No, Jill, we live in a time of rapid technology, and every day so much is happening. If you fight, you could do this. Jonah doesn't have to die.'" Photo by Dodi Holm.

Fischer's bandage went from an idea to being FDA-approved in only eighteen months. In some ways he had a head start because he was working on a device, which doesn't have to go through the same regulatory three-phase trial as pills or other therapeutics. But even working on devices, researchers can still wait years for approval.

The key to Fischer's success was probably that he developed the new bandage under the auspices of Entegriion, a company he

founded in 2002. His CEO quickly set him up with textile-industry scientists who could help him design the bandages and connect with private investors who had readily available capital. Without that, Fischer's project would've taken years longer as his team waded through academic cycles of grant funding for their research.

"The kind of money we need to truly develop an invention is beyond the scale of our current funding mechanism," explains

Cathy Innes, director of UNC's Office of Technology Development. "So if universities are lousy at development, it's because it isn't what we were set up to do. We have to find a way to get to the point where a company will invest, or start our own company."

UNC currently spins out five to ten companies a year, but efforts are under way to triple or quadruple that number in 2012.

Carolina Kickstart, an NC TraCS program that helps scientists commercialize their discoveries by providing small grants, education, and mentoring, is working closely with the Office of Technology Development to do this.

"In the life science area, there are very few ways to translate discoveries and move them closer to the patient except through commercial means," says Don Rose, Carolina Kickstart's program director. "People are trying to understand what the return on the investment is for a particular technology or a particular line of research."

Scientists can get a crash course in business through a class at UNC called Launching the Venture. Fischer took the course many years ago and says that the experience gave him the training he needed to start his business. And that business was critical when he faced the infamous gap from bench to bedside.

"That is a very real thing," Fischer says. "I managed to get across it with one product, but I have many others to go. The trick there was to get across it fast, to take a gulp of water and run."

The ability to try something new, to get out of your comfort zone, and even be willing to fail, is essential to translational medicine and to entrepreneurship. That's something

Cam Patterson learned when he started studying business.

"I didn't go to business school thinking this would turn me into an entrepreneur. But one thing it taught me was that a lot of things I did on a day-to-day basis were entrepreneurial. I'd just never seen them that way," says Patterson, who now codirects Carolina Kickstart with Rose. "And it made me realize that starting a company wasn't something for only a small subset of

individuals. If you have great ideas, you can push them forward."

Patterson is partnering with DeMore to commercialize her basic discovery so it can help treat breast and other cancers. With guidance from Joel Schaffer, an entrepreneur-in-residence, they started a company called Enci Therapeutics to drive their invention into the marketplace.

"You get to the point where it's very difficult to keep going, because you need large amounts of money the typical grant mechanism can't cover, and yet pharmaceutical companies aren't ready to partner with you," DeMore says. "So how do you bridge that gap? My goal as a surgeon who treats patients with breast cancer is to take discoveries out of the lab and into the clinic. To me, it seemed like starting a company was the only option to get that done."

Beyond the finish line

Once a medical discovery makes it through preclinical experiments, animal testing, clinical trials, and FDA approval, it will do little good if it just sits in the medicine cabinet or pharmacy. Yet there can be widespread variation in how a new drug or device, once on the market, is used clinically.

"It really comes down to communication," says Joan Cates, who has studied ways to raise HPV vaccine awareness. "I think scientists need to communicate their findings in plain language long before those findings get into practice. The public doesn't always know these treatments are out there."

There are at least two parts of the race that even increases in infrastructure, grants, and manpower can't touch. The first is human nature. Getting people to do what is best for their health is ultimately out of doctors' hands.

The second is nature itself. Technology can speed up information acquisition and make conducting global and simultaneous experiments possible. But when it comes to grasping all of the nuances and subtleties of science that determine whether a treatment will work—well, scientists aren't even close.

"I think the single biggest restriction is

human ignorance of biology," Fischer says. "It's our intrinsic limitations as intelligent monkeys in understanding nature. It's only been in the last several decades that medicine has done people any good in a statistical sense. We've made progress, but we don't know how big that unknown is. It's kind of like Columbus finding a route to Asia. He didn't find a route to Asia; he discovered North America instead. He was rejected for funding by court after court—it's the same way in biotechnology."

For her part, Jill Wood continues to work for a cure for her son Jonah. She recognizes that good science takes time, so she tries to wait patiently for the groundwork to be laid for newborn-screening tests and treatments that may one day keep others from experiencing her ordeal.

Her persistence has already paid off. She has located enough kids with Sanfilippo Type C for rare-diseases researcher Maria Escolar to start a natural-history study of the disease—a critical step before beginning any clinical trial.

"It's hard for me because I look at my son and I think, 'My God, I don't want him to die, I don't want him to have brain damage,'" Wood says. On the other hand, she says, she doesn't want a quick fix that ultimately proves ineffective. "I want it all looked at. And I really think the world needs to have it properly done." ■

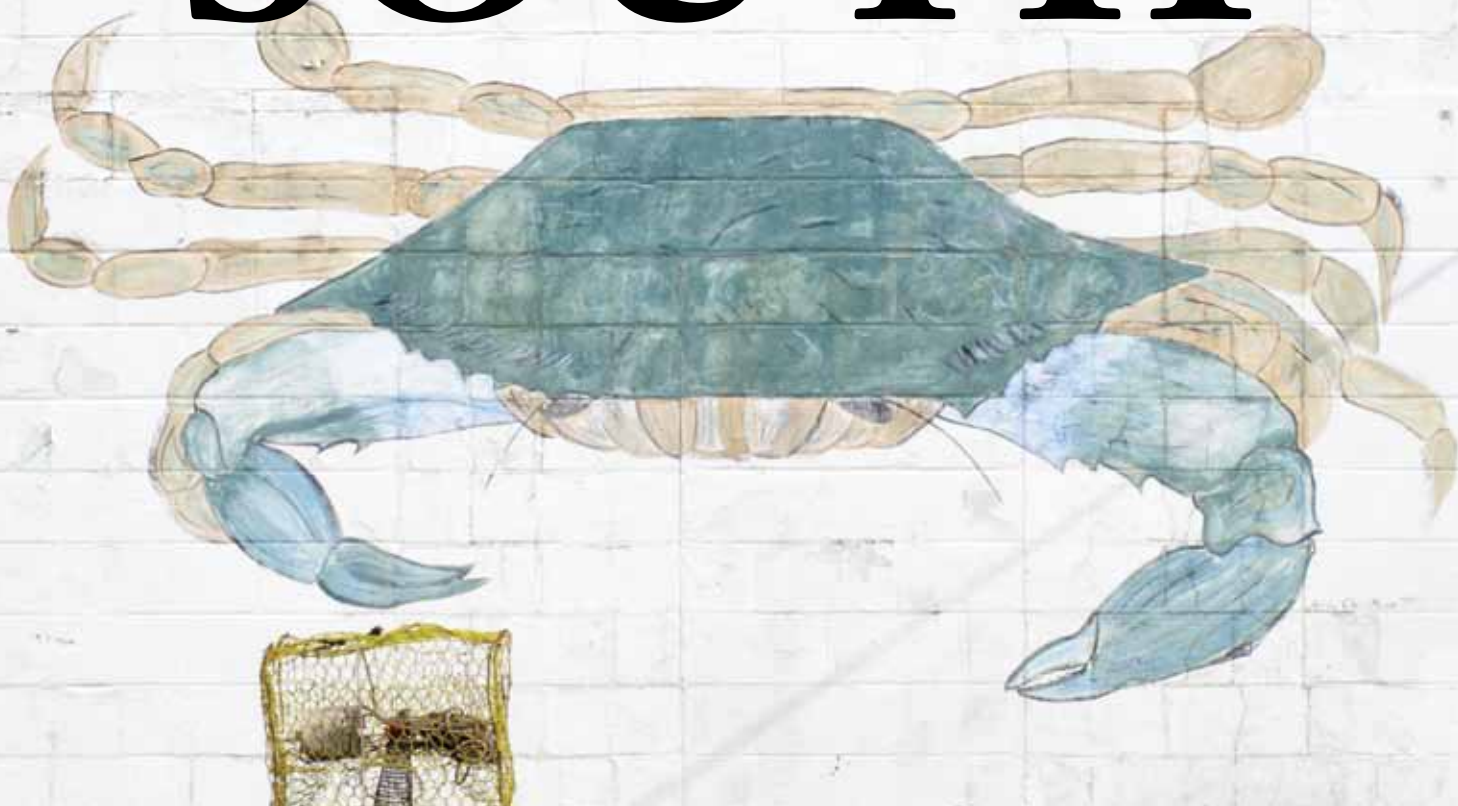
Marla Vacek Broadfoot is a geneticist-turned-science-writer living in Wendell, North Carolina.

Cam Patterson is the Ernest and Hazel Craige Distinguished Professor of Cardiovascular Medicine in the School of Medicine and director of the Carolina Cardiovascular Biology Center. Nancy Klauber-DeMore is an assistant professor of surgery in the School of Medicine and a member of the Lineberger Comprehensive Cancer Center. Howard McLeod is the Fred Eselman Distinguished Professor of Pharmacogenomics and Individualized Therapy in the Eselman School of Pharmacy. Ken Ataga is an associate professor of medicine in the School of Medicine. Launching the Venture is offered by the Kenan-Flagler Business School, with support from the Office of Technology Development and Carolina Kickstart. Thomas Fischer is an associate professor in the Department of Pathology and Laboratory Medicine in the School of Medicine. Joan Cates is a lecturer in the School of Journalism and Mass Communication.

Learn more about Sanfilippo syndrome at Jonah's Just Begun, the website of Jill Wood's foundation to cure Sanfilippo:
www.jonahsjustbegun.org



MOUTH FOR THE SOUTH



ONE MAN PLUMPS FOR DRUM HEAD STEW, HEIRLOOM SWEET POTATOES, OYSTERS WITH WHISKEY, AND OTHER TASTES OF THE DELMARVA PENINSULA

BY SUSAN HARDY • PHOTOS BY BERNIE HERMAN

Bernie Herman first heard about drum head stew from a man who'd never tasted it. When the man was young, he used to fish off the Atlantic coast of the Delmarva Peninsula. After he had his catch of drum fish for the day, he'd sit by the dock and clean it. "People would come by and ask him if they could have the head and the bones," Herman says. "He'd give it to them, and he'd say, 'What're you going to make with this?' And they'd say, 'Stew.'"

Herman knew the seafood of the Delmarva Peninsula well, but he had never heard of drum head stew. "So I started asking people," he says. "And then I hit three or four people in a row who said, 'Yeah, this is how you make it, this is what we used to do.'" That's how the food culture is on Virginia's Eastern Shore, he says. Unique, flavorful, passed from hand to hand. And many of the recipes and stories there have never traveled outside of the community.

Northampton County, at the southernmost tip of the peninsula, used to be one of the wealthiest agricultural counties in the United States, Herman says. Now it's one of the counties with the longest history of persistent poverty in Virginia. Its economy crashed during the Great Depression and never really recovered, he says.

"There's agriculture, but more and more of it is mechanized," Herman says. "And there's not much else. Years ago a company wanted to build offshore oil drilling platforms here. That never went anywhere. Then the state wanted to build a prison. That didn't work out either. The county has held off things like chicken farming and processing that could pose hazards for the fragile aquifer that sustains the area. There are limited economic opportunities, and almost anything would involve importing people to do jobs instead of giving jobs to people who are already there."

Herman started wondering what could help revive this rural, depressed county. He thought back to his early childhood; he was a very young boy when his family lived on Virginia's Eastern Shore, he says, but he remembers that time vividly. What he remembers most is the food.

"Our neighbor then was a farmer who had oysters," he recalls. "My sister and I would go over and he'd shuck us out each a raw oyster, and then he would produce this thimble and he would put a little bit of whiskey in it. We'd each have our thimble of whiskey and our oyster, and then we'd go home for our nap."



Top left: Bushel baskets of crabs stacked dockside, Bayford, Virginia. The crabs are sorted by size and sex, with number one jimmies (large males) fetching top prices for the restaurant trade. **Bottom left:** Business sign, Exmore, Virginia. **Right:** Produce shop near Machipongo, Virginia. Fruit and vegetable stands catering to neighbors and travelers alike appear seasonally along the Eastern Shore roadside.



H. M. Arnold's soft-shell crab shedding tanks, Bayford, Virginia. Arnold begins the search for peelers (crabs getting ready to shed) in spring and monitors the process in tanks filled with continuously flowing seawater. His soft-shells are sought after at New Fulton Fish Market in New York City and at home on the Eastern Shore.

One of the most powerful ways people can connect with a place, Herman says, is by eating it: partaking of a region's unique food culture. The local recipes, the stories behind them. Food, he thinks, is a resource Northampton County has yet to fully tap, and one that could turn the area into a destination for a hybrid of ecotourism and food tourism.

The first step, Herman says, is to see what's out there. Most of Northampton County's food history has never been written down or recorded—for many of the people he interviews, it's the first time they've ever had a conversation with someone about what they grow, or what they cook. He talks to people who are new to the area, and people whose families have been farming Northampton County for hundreds of years. One couple grows an heirloom strain of bloody butcher corn and mills it to make a red-speckled meal. Other families have varieties of figs they've been growing since the 1700s.

Just about everyone Herman meets has a story about food. "One time, I'd been thinking about dumplings," he says. "That day I was at the landfill, and there was this woman there, and I just turned to her and said, 'Do you like puff dumplings or slick dumplings?' And she said, 'Oh, I like slick.' So we sat there in the dump and we had this conversation about the slick dumplings her mother used to make.

"Everybody there remembers food with great affection. And everybody *cooks* something."

Last year, with southern historian Marci Cohen Ferris, Herman organized a group of food writers, editors, and chefs to visit the southern peninsula and explore its cuisine. One of them, *New York Times* food writer Molly O'Neill, picked up clam fritter and duck dumpling recipes to put in her 2010 cookbook, *One Big Table*. Others of the group have written about the Eastern Shore: its wines, its Hayman sweet potatoes, its oysters that absorb the flavors of the creeks where they're grown.

Herman has brought fresh oysters from Northampton County to Chapel Hill merchants. 3CUPS, a wine, tea, and coffee shop, held an Eastern Shore oyster tasting, where Herman introduced customers to oysters that are as distinctive as different wines or coffees—sweeter or saltier, firmer or softer. Lantern, one of *Gourmet Magazine's* top fifty restaurant favorites, now incorporates Eastern Shore oysters and sweet potatoes into its menu.

"Creating awareness and desire for what's here—that's the part of this I'm trying to work on," Herman says.

He doesn't just want to bring food tourism to Northampton County, Herman says; he wants to build a model that could be used in other places to tap into food culture. "I've been thinking about the mountains of North Carolina, and the incredible history of beans there," he says. "Bean collectors, recipes, ways to prepare beans. Beans in the mountains are the equivalent of oysters on the Eastern Shore."



Planting Hayman sweet potato slips, William Baines' farm, Eastville, Virginia. The Hayman is a prized local sweet potato that was introduced to the Eastern Shore in the mid-1800s. Delicate and greenish in hue, the Hayman is very sweet. Sweet potatoes are grown from slips rooted in hot beds and transplanted by hand to open fields.

“Almost anywhere you go, there’s that one food that a place has.”

It’s about more than bringing back the old knowledge of cooking. “You hear all these cries of dismay about the erosion of regional and local identities,” Herman says. “But things are always changing, and part of that change is how the individual and the local and the regional assert their identities in new ways.”

For example, the merging of the Eastern Shore’s best-known heirloom vegetable with a newly arrived Hispanic food: Hayman sweet potato empanadas. [e](#)

Bernard Herman is the George B. Tindall Professor of American Studies, and Marci Cohen Ferris is an associate professor of American studies, both in the College of Arts and Sciences. Herman and Ferris wrote essays about Southern food culture that appeared in the winter 2009 issue of Southern Cultures (www.southerncultures.org).

Right: Drum fish sign, Painter, Virginia. Local diners savor red and black varieties of drum, and look forward to the first appearance of the fish in spring. Drum appears on menus in the form of drum sandwiches and drum ribs, both fried. In the not-so-distant past, the large, meaty fish was the signature ingredient in dishes such as baked fish with potatoes and gravy and drum head stew.

“The drum, behind his head and gills, behind in the back there, it’s an awful lot of meat. And the backbone, of course, when you sided it off in between the backbone, it’s meat. And they would chop that up and boil it, and that gave you your seasoning. It was like marrow out of a cow. Take the bone out, and then they would chop up the meat also, and boil that in there with it. And you had almost like a stew or chowder, and you’d add your potatoes. Just like clam chowder.”

—H. M. Arnold, Bayford, Virginia (2008)



FATHER & THE FÜHRER'S WAR

THE STORY OF A PATRIOTIC SOLDIER OF THE THIRD REICH • BY MARK DEREWICZ



Konrad H. Jarausch, named after his father, was twelve years old when he first heard about the letters. There were 350 of them. His mother, Charlotte, was trying to sell them to publishers, but nobody wanted another book about the war. “Not in 1952,” Jarausch says. “Not in Germany, anyway.”

Jarausch never met his father and never wanted to hear about him or the war. But Jarausch’s mother insisted, encouraging the boy to be like his father—read the classics, study religion, be proud to be German. But the son couldn’t respect his father. “I didn’t like his conservative-nationalist politics,” Jarausch says. His father was no Nazi—he had refused to join Hitler’s National Socialist Party—but as a drafted reservist he became a cog in the Nazi war machine.

Jarausch rebelled, leaving Germany at age eighteen. “I wanted to get as far away as possible,” he says. “So I came to the United States and studied American history at the University of Wyoming.”

When his mother died in 1965, Jarausch gave away all her possessions except a few paintings, some photographs, and a brown briefcase full of letters. “I held onto them because they were the only link to my childhood, a way of keeping my mother’s memory alive,” he says. “And I suspected that if I wanted to meet my father later, I might be able to do so through these letters.”

Jarausch became a scholar like his father, arriving at Carolina as a history professor in 1983, but still he had no interest in his father’s letters. Not until sixty years after the war did Jarausch have a look. He knew that a debate lingered between German scholars and veterans about the role of ordinary Wehrmacht army units in atrocities such as political executions, reprisals, and the killing of Jewish civilians and Russian POWs. Jarausch wondered whether his father had been involved and whether his father’s letters contained any evidence about the Wehrmacht’s culpability. “And I thought that I finally had to face up to the fact that this was part of *my* legacy,” he says.

Konrad Jarausch at officer candidate training in 1941. He never became an officer. Soon after this photo was taken, in Germany, he was sent to the Eastern Front, where he watched thousands of Russian POWs die of hunger or disease. In one of his 350 letters home Jarausch wrote, “The whole thing is already more murder than war.” Photo courtesy of Konrad H. Jarausch.

NOT UNTIL SIXTY YEARS AFTER THE WAR DID KONRAD JARAUSCH HAVE A LOOK AT HIS FATHER’S WARTIME LETTERS. “I THOUGHT,” HE SAYS, “THAT I FINALLY HAD TO FACE UP TO THE FACT THAT THIS WAS PART OF MY LEGACY.”



In 2005, sitting in the study of his Berlin home, Jarausch dusted off the brown briefcase, opened it, and began reading.

GLAZNOW, Poland, October 7, 1939—*Dear Lotte, We’ve had many quiet days. Life is as regular as in peacetime... We listened to the Führer’s speech yesterday. We were disappointed that there was no news of a decision. But it did leave open the possibility of a peaceful future...*

For centuries, parts of what is now Poland had been under German rule. After Germany lost World War I, some ethnic German areas became Polish territory, leading many Germans to support Hitler’s war there. Jarausch’s father was a supporter. “This Polish state had to be destroyed,” he wrote. But he did not foresee Hitler’s grand scheme. At thirty-nine years of age, he questioned the need for his service and pined for his former life.

ZGIERZ, Poland, October 21, 1939—*Dear Lotte, I had a lovely experience recently right before falling asleep. Do you know how when you close your eyes you sometimes see shimmering? This time I saw a wonderful, bright blue. Suddenly the blue turned into a beautiful field of forget-me-nots... Then you were there in a bright summer dress and a large straw hat, and you were picking the flowers. Your white dress and hat were shimmering in between the blues. I couldn’t see your face... Then everything disappeared. Only the blue shimmered in my dreams. I want to hold onto that forget-me-not, even if it was only a dream.*

“This letter struck me like a painting, expressing a longing to return to a peaceful world,” Jarausch says. “This is one of the few places where I sense a real emotional bond to my mother, since my father’s style was intellectually open but emotionally reserved.”

The next letter was very different. Jarausch’s father had entered the Jewish quarter in the Polish city of Lodz.

October 22, 1939—*We won’t so easily forget what we saw there. How pitiful and sordid these people are in appearance... The masses pushed their way past us on the narrow sidewalks... In the alleyways they group together. Among them one finds single, small faces with burning expressions of intelligence. Every now and then one sees some elegance. But overall, there’s just poverty and misery... Our throats seized up with the smells that came out of doorways... As night fell, the fog rising from the ugly, uneven facades took on something of the grotesque.*

Jarausch’s father began to see that Poland was merely the war’s first act and that the attack on Poland had unleashed pent-up racism. Still, the letters show him as a spectator, not someone who was on the verge of acting on behalf of the Jews.

November 12, 1939—*I can see a tower of fire over the city. The Jewish baths are burning, and the synagogue was burned down last night. The fires were set by the ethnic Germans who live here... And so each of us is affected by the strange tumult of our times... Our victory in Poland has just been too easy and too quick... The enormity of the task facing us in the East (not to mention in Russia) is slowly becoming apparent.*

As Jarausch read the letters, he began to suspect that his father wasn’t a typical soldier. Drunkenness disgusted him. His father was religious; one Sunday morning he found himself alone at church. He read the classics in their original Greek and Latin. And he requested Polish language books. “Why would my father learn an ‘inferior language’ of a race of so-called ‘sub-humans?’” Jarausch wonders. “I think he *wanted* to make contact.”

In 1940 Jarusch's father still supported the war. He tried to become an officer. In 1941, though, when Jarusch's father was called back to Germany as a drill instructor, he tried to get released from military duty. Jarusch says his father's request was based more on a desire to return to his life than it was a repudiation of the war effort. When Hitler announced the invasion of Russia, Jarusch's father knew where he'd be sent.

June 22, 1941—Dear Lotte, I heard a repeat broadcast of the Führer's announcement. What solemn news... One will have to do what one is ordered to do. But don't fear. Keep yourself free from all trouble. Pray and read the psalms so that you can prepare yourself for your coming tasks. Don't be overcome by worry or sorrow...

Jarusch's father left for the Eastern Front on August 9. Five days later Lotte gave birth to their only child. Jarusch's father wouldn't get the news until September 6, 1941. But he sensed what was going on back home and how difficult life alone must have been for his wife.

KOCHANOWO, Russia, August 15, 1941—Dear Lotte, What you are going through is too much, especially because it is ultimately not necessary. I wouldn't say anything if I thought that my service was essential and extremely urgent. But I can't bear this mixture of thoughtlessness and vexation; it really is just the last straw... On Monday I attempted to master my feelings so that our farewell wouldn't be too painful.

As the German army blitzed through Russia, Jarusch's father was never stationed far from the front, spending most of his time at Dulag 203, a transit camp where POWs were sorted before being sent farther from the front. Camps meant to imprison two thousand POWs were forced to house tens of thousands. Resources were stretched thin. In the end, more than two million Russian POWs died.

DULAG 203, Russia, August 1941—Ten thousand to twelve thousand prisoners... marched thirty to forty kilometers from the front; they were soaked; they had gone days without food... Their hunger drove them to the kitchens. Shots were fired to keep them in order. Some (not many) were killed. Others rolled around in the mud, howling from their hunger pains. The next morning several corpses were pulled out of the mud; only their legs or heads stuck up out of the mess.



COURTESY OF KONRAD JARUSCH

Jarusch's father was put in charge of a field kitchen where there was never enough food, even before Wehrmacht leaders reduced POW rations to below the Geneva Conventions' minimum requirement. He continually argued with the quartermaster to send more food and better cooking equipment. His requests denied, Jarusch's father became disillusioned with the war in general. But because of manpower shortages, there was no way out by that point, Jarusch says.

November 14, 1941—The dull dying around us is just so terrible... twenty-five prisoners die daily... One tries to help. When they come to get their food and are frozen stiff from the cold, they stagger, fall over, and expire right at our feet. The corpses... are scrawny like late gothic figures of Christ, frozen stiff... There are civilians among the prisoners, many who are just in shirt-sleeves—especially the Jews. It would really be the most merciful thing if they would be taken out into the forest and bumped off, as the experts put it. But the whole thing is already more murder than war... We've just been thrown into this situation, incapable of doing anything other than our limited duty.

According to the letters, Jarusch's father scrounged for wood to heat stoves and organized German soldiers and POWs to cook. "Racist SS officers objected to these efforts," Jarusch says. "And cyni-

"THE SS IS CLEANING UP TERRIBLY. EVERYTHING BOLSHEVIK IS BEING RUTHLESSLY ERADICATED WHENEVER IT FALLS INTO OUR HANDS. DITTO THE JEWISH ELEMENT."

—KONRAD JARUSCH,
OCTOBER 1941

cal nationalists told him to forget helping Slavic subhumans." One superior told Jarusch's father: "If you're in this job you have to harden yourself. And what does it matter if five hundred more die?"

Jarusch's father referred to the camp as a tragedy. A believer in the Jesus who gave the Sermon on the Mount, he looked for help among the educated Russians, with whom he spent a lot of time. They shared stories of home. One prisoner taught him Russian. Others sketched him. One POW gave him a drawing of Lotte holding her baby. In one letter, Jarusch's father wrote: "I haven't felt such close human relations since I left home as the ones I now have with my Russians."

As Jarusch's father's nationalistic fervor waned, his Christian ethics came to the fore.

October 23, 1941—The running of the camp has fallen in large part on me... I'm constantly reminded of Matthew 25:42-43. ["For I was hungered, and ye gave me no meat; I was thirsty, and ye gave me no drink."] I can't stop thinking about the passage. I'm trying to do what I can. It's not much in the face of the worst suffering I've encountered in my life. But perhaps I can prevent further calamities. The Russians are helping me... I would like to be able to focus again solely on securing provisions. But at the moment the question is simply: who is your neighbor?

Jarusch says these letters from Russia raise questions about which values soldiers should cling to during wartime—a sense of national obligation or a commitment to humanity that transcends national boundaries? Jarusch's father was leaning toward the latter, but it's unclear what actions he would've taken during the last three years of the war.



Above left: Russian POWs in 1941 fed their comrades with the little food their German captors had provided. **Above right and below:** Konrad Jarausch befriended POWs as he tried to save them from starving to death. One POW taught him Russian. Another sketched Jarausch and his family, including the son he would never meet. Images courtesy of Konrad Jarausch.

Late in 1941 typhoid broke out in nearby Russian towns. Some POWs became infected. Jarausch's father was stricken in January 1942. Lying in a field hospital bed, he wrote his final letter to his wife.

ROSLAWL, Russia, January 13, 1942—Dear Lotte, I only have time for a short note today. I thank you so much for your many letters from the last days of last year and then those from the new one. I am touched and thankful for all the heartfelt love that speaks from each of them. May God bless our wishes for the future. Everything is now in His hands. Here it's horribly cold. But I'm well covered. Thank you so much for the wonderful presents... I'm so pleased to hear that the little one is so full of life and high spirits. Now goodbye and be well together with our child.

He died four days later. His son was six months old.

For Jarausch, the letters shatter the myth that ordinary army units were innocent. Regular soldiers, not just the SS, caused the deaths of millions of POWs, rural Russians, and Jewish civilians. "I always knew the Wehrmacht was nasty," Jarausch says. "But to read those descriptions and to see the sense of helplessness that my father felt was something I just didn't expect. Many of the so-called 'good Germans' not only knew of the Holocaust but became reluctant accomplices in it, because they kept doing their duty. They didn't opt out."



Had Jarausch's father refused to be drafted or had he gone AWOL, he would've been court-martialed. But there's no sign that Jarausch's father wrestled with any of those options. Also, Jarausch says that his father didn't pursue with enough vigor a job away from the front and the atrocities. So Jarausch doesn't let his father off the hook. "His values led him to become an accomplice in something we have to reject," Jarausch says.

Still, Jarausch was moved to read his father's remarks about the birth of the son he would never meet.

"The joy he expressed was like a hand

reaching out to me," Jarausch says. "It humanized him. He wasn't just a stern scholar, a painting on the wall. These letters showed me who he was and that he would've been a loving father. And because that's something I never had, it was something I responded to." ^e

Konrad Jarausch is the Lurcy Professor of European Civilization in the Department of History in the College of Arts and Sciences. His book, Reluctant Accomplice: A Wehrmacht Soldier's Letters from the Eastern Front, was translated from German into English and co-edited by Eve Duffy, director of UNC's Program in the Humanities and Human Values.

CAROLINA UNDERGRAD RESEARCH

UNC students don't just go to class.
They work in labs and in the field.
They create. They answer their own questions.

Here are three stories about Carolina undergraduates and their work. First up:

The Fog of Chronic Pain

Can music treat a condition that debilitates millions of Americans?

by Mark Derewicz

The pain was particularly intense when she swam the breaststroke. “My legs would bend back and my kneecaps would bang against the cartilage,” Alicia Mullis says. “That’s not supposed to happen. The cap should fit in a nice little groove, but my kneecaps are a little off-center.”

For years she endured chronic pain, some days struggling to walk. But it was never bad enough to make her stop swimming. As her high school athletic career went on, Mullis did exercises to strengthen her knee tendons so that the caps would be more centered. While she was an undergrad at UNC, the pain became more manageable—nothing an ice pack couldn’t handle. Looking back, though, she can’t give all the credit to sports medicine. Mullis now thinks something else helped her cope with her faulty knees: playing music.

Mullis has played the piano since she was seven and the clarinet since she was eleven. Her music teacher once told her she was good enough to study either instrument in college. “I considered majoring in music,” Mullis says. “But it’s such a competitive field, and I felt I had other options.” She settled on psychology and biology—with a minor in Arabic—and then joined the lab of psychologist Mark Hollins.

At first Mullis didn’t think playing music had anything to do with relieving her own chronic pain. She just wanted to do research that would have real-life implications for others. But dur-

ing a course on evolutionary psychology, a few short textbook passages piqued her interest in music’s evolutionary role. “It’s a phenomenon that evolutionary psychologists can’t explain,” she says. Why did humans start playing musical instruments?

Mullis thought that maybe music had functioned as a kind of pain modulator for humans living tens of thousands of years ago. That is, playing music somehow helped the brain cope with pain.

Mullis devised a project to test her hypothesis. She recruited forty-one UNC students and used a standard survey to sort participants by whether they had chronic pain and whether they played music. She gave each participant two cognitive tests: a letter-counting task and a number-prediction task. Researchers in the past had used similar methods to show that chronic pain sufferers struggle with cognitive tasks. And clinical observations showed the same thing, Mullis says. Fibromyalgia patients, for instance, often say they feel like they’re in a fog; their brains don’t function as well as other people’s brains.

Mullis found that people who have chronic pain and play music at least once a week did substantially better on cognitive tasks than people who have chronic pain but don’t play music. Her results also showed that people without chronic pain who play music didn’t do any better on the cognitive tasks than people without chronic pain who don’t play music. Music, her findings suggested, had a protective effect against chronic pain.



Alicia Mullis wondered if humans originally began playing music as a way to cope with pain. Here, she explains her research findings at a poster session that was part of the Twelfth Annual Celebration of Undergraduate Research. The event honored National Undergraduate Research Week. Photo by Donn Young.

The number-prediction task, which involves making decisions, was such a good predictor of musicians maintaining cognitive skills that Mullis hopes the test can be turned into a diagnostic tool. “It’s really hard sometimes to differentiate between acute and chronic pain,” she says. “Those patients need to be treated differently. A new tool would be enormously helpful to the field.”

Mullis says that music doesn’t work like a pill or an ice pack. When her knee would flare up after swimming, she wouldn’t towel off and play the clarinet to soothe it. Instead, the theory goes, playing music for years helped Mullis’s brain cope with pain better than had she not played at all: it helped train her brain to not focus on the pain.

Whenever a person experiences the same pain stimulus over and over, brain neurons fire in consistent ways day after day for months or even years. That much is fact. What that does to cognition is unclear, but Mullis says that those neural responses may train the brain to process specific pain stimuli at the expense of other impulses. The result would be loss of cognitive ability, which is what those tried-and-true cognition tests have predicted. “Think about it like a neural rut,” she says. “Interactions between the brain and body become more linear.” Brain activity becomes simplified and focused. That’s called decomplexification, and it

Playing music helped Mullis train her brain to not focus on pain.

can lead to all kinds of problems, including lower pain thresholds and emotional sensitivity. Patients can’t help but focus on the pain.

Music, Mullis says, might serve as a kind of countermeasure—a *recomplexifier*. “Brain imaging studies have shown that when people play music, their brains just light up,” she says. Playing music is about complex patterns interacting, and many parts of the brain are involved. That’s the way the brain was meant to function. That’s how our brains *do* function, until chronic pain takes hold. Music may prevent the ruts from getting too deep, Mullis says, which helps people avoid the worst that chronic pain has to offer—such as depression, or a diminished capacity to make decisions. And that could explain why chronic pain never got the best of her.

“I don’t know if my data say as much about recomplexification as about music being effective for people with chronic pain,” Mullis says. “But it’s an interesting idea that’s worth looking into.” Mullis might do just that in grad school. She wants to publish her thesis and work for at least a year before choosing a doctoral program. “I want to make sure I choose the right one,” she says. **e**

Alicia Mullis graduated in May 2011 with a bachelor of science degree in psychology and biology and a minor in Arabic from the College of Arts and Sciences. A Dunlevie Honors Undergraduate Research Award helped fund her project.

Devil Down in Hill Country

Reed Turchi hunts for that north Mississippi sound.

by Margarite Nathe

“Jesus on the mainline, you better tell him what you want. You better call him up and tell him what you want...”—“Jesus on the Mainline,” by Kenny Brown

What Reed Turchi wanted was to stay upright. But after Kenny Brown had told him he needed to “ride the horse and not the saddle,” Turchi started riding bareback. He’d fallen face-first into the dirt four times already. They finally called it a day after the fifth. Brown laughed. “We’re going to have to stop until we can get a video camera down here.” They needed to get back to work, anyway.

Brown is a blues legend, but he keeps a low profile. He and his wife Sara have a farm to run, so he doesn’t often play in public anymore. For the past year, when Turchi hasn’t been in school at UNC or helping out around Brown’s place, he and Brown have been sitting together on the front porch, Turchi with his recording equipment, Brown with his acoustic guitar and lap steel, recording Devil Down Records’ fourth album.

Turchi founded the label in 2010, when he produced *Come and Found You Gone* by Mississippi Fred McDowell (see *Endeavors*, Fall 2009, “*Bill Ferris and the Gut-Bucket Blues*”). Serious blues fans loved it. It was on the ballot for a Grammy. After *Come and Found You Gone*, Turchi got in his car and drove from Chapel Hill to the hill country of north Mississippi to get to know some hill country blues musicians and record their sounds. That’s where he met Brown.

Hill country blues is different from the blues down in the Delta, Turchi says. There’s a family resemblance, sure, but each has its own soul. The Delta blues has roots in solo performances—a single musician, singing and playing an acoustic guitar. But hill country blues stems from gatherings of fife and drum players. It’s more beat-driven—the drums set the rhythm for the flute-like fife, the slide guitar, and other instruments. There aren’t as many chord changes in hill country blues songs—they’re usually wrapped around a steady, repetitive rhythm, a groove.

Turchi was a stranger in Mississippi. It’s tough to hollow out a spot for yourself with the locals in any new town, but getting close to musicians is an especially delicate business. They tend to be secretive about their tricks and techniques, Turchi says.

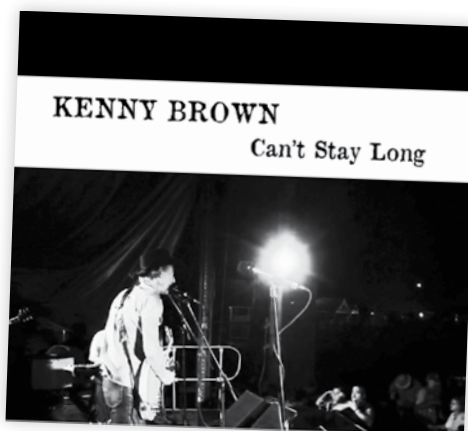
Take Little Joe Ayers, for example. “Little Joe plays a unique style,” Turchi says. “No one else alive really plays at all like him. The couple of people who did are dead.” Ayers’s music is hypnotic and repetitive, the way John Lee Hooker, R.L. Burnside, and Junior Kimbrough (with whom Ayers played for years) played when they were still alive.

Whenever someone asks Little Joe for guitar lessons, he gets cagey, Turchi says. “It’s like, ‘You have to play like *you* play, not like *I* play,’” Turchi says. “If someone asks him to show how he plays a riff, he’ll kind of do riffs around it and never play the riff by itself. He might even throw in another note or some other chords around it to make it sound different.”

Turchi’s first conversation with Ayers was a little like that. They’d sat down for lunch at a gas station so Turchi could interview him about his music. Ayers deflected Turchi’s first few questions and sat like a stone before finally interrupting.

“Look,” Ayers said. “Say I’m sorting through a bunch of gallons of milk and you’re my assistant and I’m supposed to train you on how to do it. If you ask me the trick to finding the *one bottle* of spoiled milk in the whole refrigerator, I’ll stand there in front of you and go through every bottle until I find the one that’s spoiled. Even though I know the whole time where exactly that one is. And if you look away, I’ll just go get it.”

The moral of the story, Turchi finally figured out, was to never ask musicians direct questions about the way they do things. Unless you want to get sent around the bush.



Can't Stay Long, the new two-disc album by Kenny Brown on Reed Turchi's Devil Down record label.



Reed Turchi in his Chapel Hill apartment surrounded by CDs from Mississippi Fred McDowell, Kenny Brown, and other north Mississippi hill country artists he has recorded for his Devil Down record label. Photo by Donn Young.

Plenty of blues musicians have gone sour on outsiders from big universities after too many decades of academics going into the communities to record music and giving nothing in return. But Turchi's persistent and he works hard, whether it's shoveling ditches on Brown's farm or helping Ayers navigate publishing rights to his songs.

"I think a lot of it is really being willing to help and not shying away when you're asked for something in return," Turchi says. "I do a lot of work with the North Mississippi Hill Country Picnic, I do a lot of work with the Browns. I don't make much money on the CDs, if any. The business is built in a way that gets the artists a lot of the money and covers the cost of production."

Turchi was a stranger in Mississippi. And while it's tough to hollow out a spot for yourself with the locals in any new town, getting close to musicians is an especially delicate business.

Devil Down Records' newest album, Kenny Brown's *Can't Stay Long*, is split into two discs. On one—labeled "Money Maker"—are live recordings from the 2010 North Mississippi Hill Country Picnic ("so you get some sounds from Potts Camp, Mississippi, sprinkled in with it," Turchi says). On the other, "Porch Songs," are the recordings Turchi made on Brown's front porch. "It's the best acoustic solo album you'll ever hear," Turchi says. The *Oxford American* agrees: "If you're a blues fan, you'll love it." One song, titled "World War I," was written by Brown's friend Mississippi Joe Callicott

during the draft of World War I. This is the first time it's ever been released on an album. This fall, Devil Down Records will release an album of Little Joe Ayers' music, too.

"I think being able to actually help and stay around, stay committed to it, is the biggest way to make a difference," Turchi says. "All my contacts with everyone there are based on music or music business. But obviously their lives are not just music. Especially folks like Kenny. It's romantic to think that he'll sit around and strum all day out on the porch, but no, he's got other stuff to take care of." ■

Reed Turchi is a senior majoring in American Studies and is head of Vinyl Records at UNC (see Endeavors, Fall 2010, "For the Record"). Devil Down Records (www.devildownrecords.com) founded the Sounds of the South Award, which allows a UNC undergraduate to record musicians in any genre of southern music and to submit a copy of the recordings to the Sounds of the South archive at the UNC Southern Folklife Collection. Turchi's work is funded by a Summer Undergraduate Research Fellowship and a JNO Award in entrepreneurial studies.

Portrait of a Village

Jobs and workers are trickling away from this tiny Turkish town. Who's left behind?

by Margarite Nathe

photos by Zoe Litaker

When Turkish carpets are first dyed, they come out in wild, vivid colors, says undergrad Zoe Litaker. But most buyers prefer an aged look. When Litaker first visited Turkey in 2008, several families in the village of Esenler made a living by sunning the carpets to fade them. Since part of the job was to guard the carpets, which are worth a lot of money, Litaker sometimes slept outside on them in what her host family, the Doğdus, called *Yıldız Otel*—"the Star Hotel."

But by the time Litaker returned to Esenler in 2011, the carpets were gone, along with many of the people. The village, already small, had shrunk to a population of about 750. Sunning carpets wasn't earning the villagers enough money, they told Litaker, so they had switched to growing more fruit crops. But while some modern technology exists in the village—many homes have cell phones, TVs, and refrigerators, and there are several cars in town—farm work in Esenler is still done the old-fashioned way. The farms there have a hard time competing with Turkey's larger agricultural operations.

There are far more jobs—and high school, for those who can afford it—in Konya (population one million) than in Esenler. So every few days, a van threads its way through the Taurus Mountains,



Fadime Ergül.



Damla Bozdağ. The children of Esenler will have to leave the village if they plan to stay in school beyond the elementary grades. "And to find the kinds of jobs they'll learn about in a globalizing, urbanizing world," says historian Sarah Shields, "they'll have to go to the cities."



Ekrem Abi Dođdu. Older men and women make up more than a third of Esenler's population now that many working-age adults have left to find jobs elsewhere. Today some 70 percent of Turkey's people live in the cities.



Cennet Bozdağ shows off her henna-painted fingernails and holds a photograph of herself that Litaker gave to her. “She was spunky, a little bit shy,” Litaker says.

shuttling workers to the city, which is over a hundred miles away.

“Since the 1950s, people in the countryside throughout the Middle East have seen much more opportunity for education and employment in the cities—Istanbul, Ankara, Cairo, Damascus,” says historian Sarah Shields, Litaker’s project advisor. “A large part of the Turkish population has been migrating to big cities, or to Europe. Istanbul now has 16 million people, and many of them come from the countryside.” Today only 30 percent of Turkey’s people live outside the cities.

Litaker found that working-age villagers were leaving Esenler in droves. What was their exodus doing to the village’s population? Who was missing? Who stayed behind?

Litaker found that working-age villagers were leaving Esenler in droves. But she wondered what their exodus was doing to the village’s population. Who was missing? Who stayed behind? When

Litaker returned in 2011, she set out to find answers. She interviewed several villagers and took photographs of 105 people, creating a visual representation of Esenler’s new demography.

The most notable absence in the village today, Litaker found, is that of young men. Many have already moved to Konya or emigrated to other countries. Those who have stayed behind now make up only 10 percent of the village’s population. In fact, the overall number of men and women between the ages of 18 and 40 has dropped sharply, now accounting for only 24 percent of Esenler’s residents. Villagers over 40 make up 34 percent, evenly split between men and women. And the children now dominate Esenler, Litaker says, making up 42 percent of the population.

“I had a posse of children while I was there,” she laughs. They followed her everywhere. She chatted with them in her rudimentary Turkish and taught them how to make a fish face. They were thrilled to discover and plunder her small stash of makeup.




Litaker photographed villagers' hands as well as their faces. Many show a lifetime of hard work. Litaker photographed this man, named Mehmet Ergül, and gave him the portrait to keep.

Mustafa Kaan Güneş.



During Litaker's first trip to Turkey in 2008, she traveled with Shields and nine other undergrads. "I was really struck every time I walked with Zoe in the city or in villages, or any place we went, because she noticed things that I never noticed," Shields says. "I've been to Istanbul many times, but she showed me a different way of looking at things through her photographs."

When Litaker visited people in their homes, most of them were eager to sit her down to look at their photo albums. She says, "The first thing almost everybody said was, 'Come sit. These are all my relatives.'" 

Zoe Litaker graduated from Carolina in May 2011 with a degree in studio art. Her first trip to Turkey was funded by the Burch Fellows Program Field Research Seminar and her photography project was funded by a Summer Undergraduate Research Fellowship. Sarah Shields is a Bowman and Gordon Gray Distinguished Term Professor in the Department of History in the College of Arts and Sciences.



Clockwise, from top left: Mehmet Ali Bozdağ, Sema Doğdu, Riza Sevgi, and Emine Yakut.

FICTION

Mississippi burning

by Jason Smith

The Queen of Palmyra. By Minrose Gwin. Harper Perennial, 416 pages, \$14.99.

The icings were the thing. They had to be timed to the split second, or else they would turn into wet sugar grit. When that happened, Mama would get mad as fire and start yelling her worst curse word, which was “Damn it the hell.” She said icing was like some folks’ lives: Timing is everything and when things go bad they go really bad. They settle into sludge. They cannot be undone.

Small-town Mississippi, summer of 1963. Florence Forrest is a ten-year-old white girl. Her father, Win Forrest—that’s “Forrest” with two R’s, he says, like the great Confederate general Nathan Bedford Forrest—sells burial insurance door-to-door in Shake Rag, the black section of town, and spends his nights fuming and stomping off to secret meetings. Florence’s mother is the town’s cake lady—six-layer lemon with divinity icing, four-layer devil’s

food with angel icing, three-layer white with caramel fudge. She sells them to other ladies for their Saturday matinee clubs and bridge parties and anniversaries. She spends her nights in a hot kitchen, baking and washing, baking and washing, and taking little nips of the liquor she buys from the black bootlegger across town. Florence waits and watches.

And she hears stories: her grandfather reads her Uncle Wiggily tales. Her father Win tells her stories about Bomba, a noble white boy living in the jungle surrounded by dull-witted, dark-skinned natives. And Zenie, the black maid of Florence’s grandparents who looks after Florence on the side, tells her stories of the great Queen Zenobia of Palmyra, who would lead warriors into battle with one breast bared and who, when she was finally captured by the Romans, insisted that the chains that kept her prisoner be made of solid gold.

Florence, for her part, tells us her own story: she understands and misunderstands as only a child can, but we also hear from her as an adult. “I need you to understand how ordinary it all was,” she begins.

Trouble starts when Zenie’s niece Eva comes down from Raleigh to try to make a little money so she can enroll for another year of college. Eva starts to tutor Florence in parts of speech and diagramming sentences—Florence has missed some school because her father couldn’t or wouldn’t work at any one place for long, but she needs to get ready for fifth grade. When Eva also tries to sell burial insurance door-to-door in Shake Rag, someone attacks her and burns a hole into her cheek with a car’s cigarette lighter.

Florence’s mother, demoralized and sinking deeper into drink, accidentally-on-purpose drives one night into the path of an oncoming train. She’s broken up enough to earn a long stay in the hospital and, after that, a longer one in a mental ward. Lying awake in bed one night, Florence decides she needs to keep her mother’s cake business going. But when she sets the kitchen afire, the hate that has been simmering in Win Forrest boils over.

Gwin gives the book’s saintly characters their share of foibles and flaws. And she develops even her most despicable character, Win, with the kind of patience and attention that keep us wondering who he really is, and why. “I wanted readers to discern what made Win such a terrible person, and to have a mixture of emotions for him,” Gwin says. “I wanted that to mirror the mixed emotions that Florence has for him.”

Some stories burn hot, cooking down quick and clean to a tidy, well-timed end. And some, like this one of Gwin’s, smolder like a pot forgotten on the back of the stove, bubbling down to a dark, wet scab that won’t scrub out.

Minrose Gwin is the Kenan Eminent Professor of English in the College of Arts and Sciences. The Queen of Palmyra is her first novel. Her memoir, Wishing for Snow, has just been released in paperback by Harper Perennial. For more information about Gwin and her work, go to minrosegwin.com.



DUNCAN WALKER



The upper section of Yosemite Falls. The water flow varies seasonally: in August, the falls are sometimes completely dry. In April and May, enough water passes over the falls each day to fill a large football stadium. At peak flow, Yosemite Falls pushes out over three tons of water per second. Photo by Allen Glazner.

GEOLOGICAL SCIENCES

Yosemite rocks

by Jason Smith

Geology Underfoot in Yosemite National Park. By Allen F. Glazner and Greg M. Stock. Mountain Press, 300 pages, \$24.00.

Yosemite National Park is a staggering piece of work: sometimes, says Allen Glazner, people spontaneously decide to hop on a plane or drive all night just to spend one day there. And people seeing the park for the first time sometimes can't help crying.

Yosemite is three-quarters of a million acres of mountains, rock avalanches, landslides, meadows, sequoias, glaciers, lakes, rivers, and waterfalls. It's hard to look at many of the geological formations there—the dizzying cliffs of Yosemite Falls, say, or the sheer granite crest of Half Dome—without wondering how they came to be. Glazner's latest book is a user's guide to the whole shebang: it explains, in very clear terms, the geology underlying each of the park's iconic formations and features.

The creek that feeds Yosemite Falls, for example, runs through a relatively shallow notch it has carved in the rim of Yosemite Valley. But just to the west of the falls lies a steep ravine (visible in the photo above as the dark, heavily vegetated area to the left of the falls).

This ravine, Glazner says, seems like a more obvious path for the creek to take. So why is it plunging off the edge of the cliff instead? The answer, he says, is that the creek got pushed: over the past two million years, several glaciers formed at the creek's headwaters and crept slowly down Yosemite Valley. In fact, one glacier moved down the valley and stopped right before the spot where the water now shoots over the cliff. As these glaciers melted, they left long lines of boulders—what geologists call terminal moraines—along with smaller rocks and sediment across the creek and through the valley. Over time, the creek had to detour to get around all of this stuff. Were it not for the glaciers, the creek would likely still be bubbling meekly through the ravine instead of soaring off the cliff.

Glazner's book is divided into twenty-five vignettes, each of which features and explains a prominent characteristic, formation, or area of the park. Each vignette includes specific directions and maps to allow you to get to the site. There's a vignette on Half Dome, one on Little Devils Postpile, and one on the El Capitan Moraine. Along the way, you'll learn how earthquakes, rock avalanches, and water have shaped Yosemite. You'll learn how gigantic boulders get carried off and deposited onto precarious perches. And who knows? Maybe you'll even be inspired to spontaneously hop on a plane.

Allen Glazner is the Kenan Distinguished Professor of Geological Sciences. Greg Stock is Yosemite's first-ever park geologist.

Who really wrote the Good Book?

by Mark Derewicz

Forged: Writing in the Name of God—Why the Bible's Authors Are Not Who We Think They Are. By Bart Ehrman. Harper One, 307 pages, \$26.99.

"Do not be quickly shaken from your mind, nor be troubled either by spirit or by word, or by epistle as from us, that the day of the Lord is at hand. Let no man beguile you in any wise."

That's a verse attributed to Paul in the New Testament. It's a warning to readers that a forged epistle was in circulation throughout Christendom.

"There's an interesting irony connected with this passage," Bible scholar Bart Ehrman says. Second Thessalonians, the book in which the passage appears, is a forgery.

Scholars have widely agreed that someone else wrote six of the thirteen letters attributed to Paul. "But they call them *pseudepigrapha*, a Greek word meaning 'bearing false title,'" Ehrman says. "They don't use the word 'forgery' because they say that using someone else's name was common practice in antiquity, especially among philosophers." So scholars don't make a big deal about it.

Ehrman spent five years researching *pseudepigrapha* in antiquity, finding stacks of evidence to debunk the notion that this form of name-stealing was an accepted practice in general and especially in regard to the Bible.

In the fourth century, when Church leaders were deciding which books to include in the New Testament, they were well aware of forgeries. Take two letters Peter allegedly wrote. "In their original Greek, the writing styles are very different," Ehrman says. "It's like reading Mark Twain and then T.S. Eliot." Some Church fathers suspected that Second Peter was a forgery. Those leaders didn't want to include it in the Bible, but they lost the debate. Both letters were included, and according to Ehrman's research, Peter probably didn't write either of them.

By Ehrman's count, eleven books of the

New Testament are forgeries and eight were written anonymously, including the gospels attributed to John, Mark, Matthew, and Luke. Also, the John who wrote Revelation is not the same John who may have written the gospel.

Does any of this diminish biblical truth? "On one level, no," Ehrman says. "If Einstein didn't really come up with those equations, well, you'd still say they were valid." On the other hand, he says, the distinction can matter a lot. For instance, Paul's first letter to Timothy includes strong language about how women should be submissive to men. "People have long

accused Paul of being a misogynist," Ehrman says. "But the problem is that Paul didn't write First Timothy. It's a forgery. It seems to me that this matters."

Bart Ehrman is the James A. Gray Distinguished Professor of Religious Studies in the College of Arts and Sciences. He is the author of many books, including Misquoting Jesus and God's Problem.

Biblical forgery: True or False?

1: Very few forgers in the ancient world were actually caught red-handed.

2: As early as the second to fourth centuries, a number of the books of the New Testament were already being disputed as forgeries.

3: Forgery was not widely condemned in antiquity.

4: Of all the Bible's disputed books, Second Peter is the one New Testament scholars are most likely to call a forgery.

5: In antiquity, many more people could read than could write.

6: The apostle Paul was convinced that the world would end in his own lifetime.

7: Ecclesiastes, ostensibly written by Solomon, could not possibly have been written until six hundred years after Solomon's death.

8: Paul never used secretaries (or scribes) to write his letters.

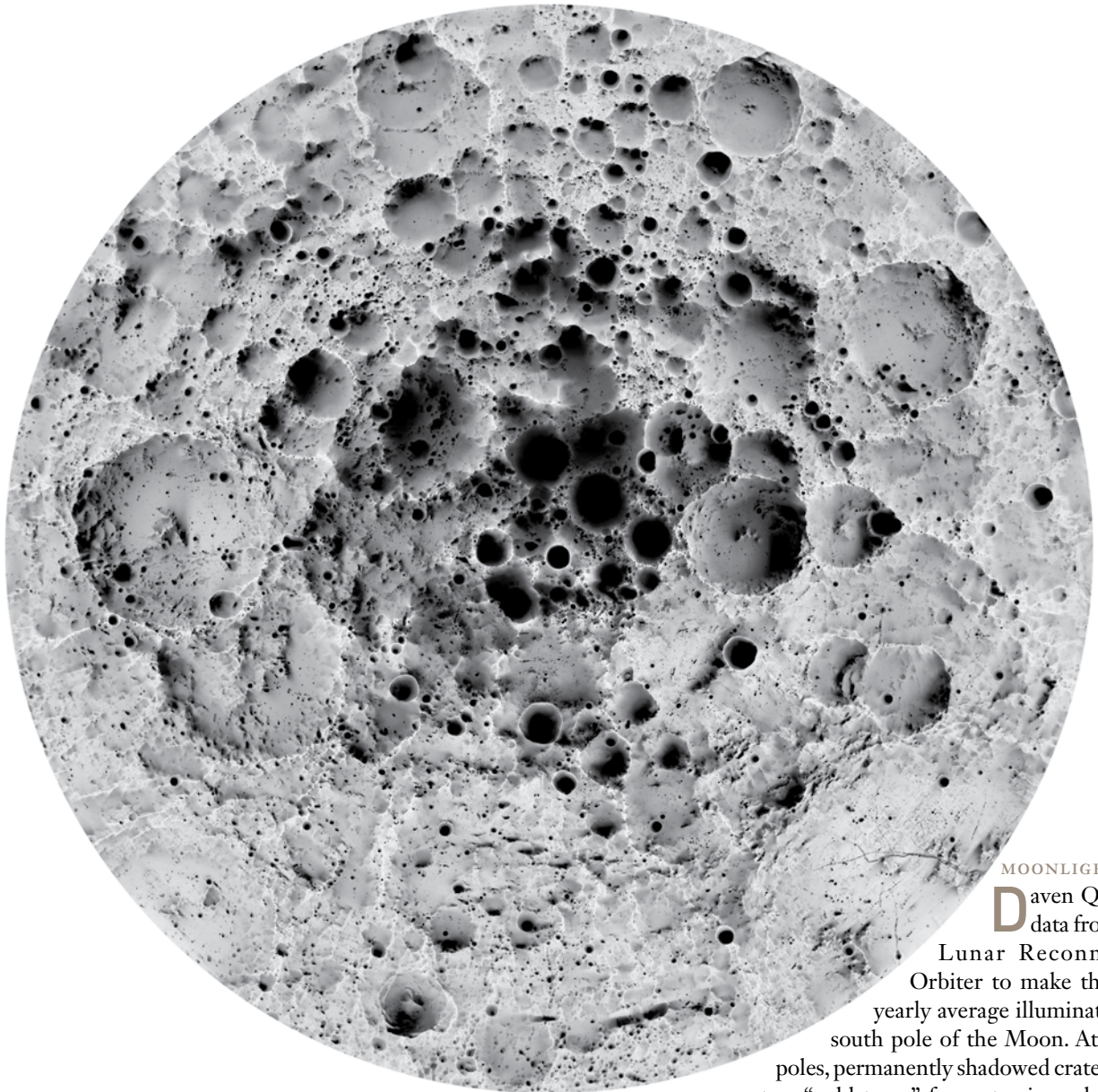
9: There were no laws against forgery in the ancient world; at the time, it would not have been considered illegal.

10: Even in its earliest days, Christianity was an illegal religion and was persecuted by the Roman Empire.



The apostles Paul and Peter as portrayed in a stained glass window at St. Aidan's Cathedral, Enniscorthy, County Wexford, Ireland. Bible scholar Bart Ehrman says that much of the writing attributed to Peter and Paul was in fact written by someone else. Photo by Andreas F. Borchert.

1. True. (See page 3 of Forged.)
 2. True. (Page 21.) 3. False. (Page 37.)
 4. True. (Page 68.) 5. True. (Page 73.)
 6. True. (Page 106.) 7. True. (Page 117.)
 8. False. (Page 134.) 9. True. (Page 140.)
 10. False. (Page 164.)



MOONLIGHTING

Daven Quinn used data from NASA's Lunar Reconnaissance Orbiter to make this map of yearly average illumination at the south pole of the Moon. At the lunar poles, permanently shadowed crater interiors may act as "cold traps" for water ice, while nearby ridges can be lit up to 90 percent of the year. Because of their constant power availability and stable surface temperatures, Quinn says, areas that get near-continuous illumination make attractive targets for exploration.

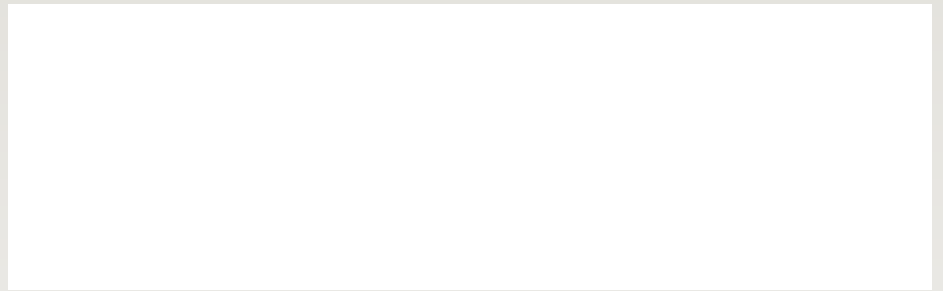
Daven Quinn graduated from Carolina in spring 2011 with a double major in geology and economics. Quinn's image was an entrant in the 2011 scientific art competition held by the Chapel Hill Analytical and Nanofabrication Laboratory at UNC. See more at endeavors.unc.edu/nanofabulous_2011.



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After twenty-seven years as a continuously printed, award-winning publication, the magazine you are holding is soon to be no more. We will no longer be able to print it. Details inside the front cover.

endeavors

Jobs and adults have left the Turkish countryside. Story on page 24. Photo by Zoe Litaker.

