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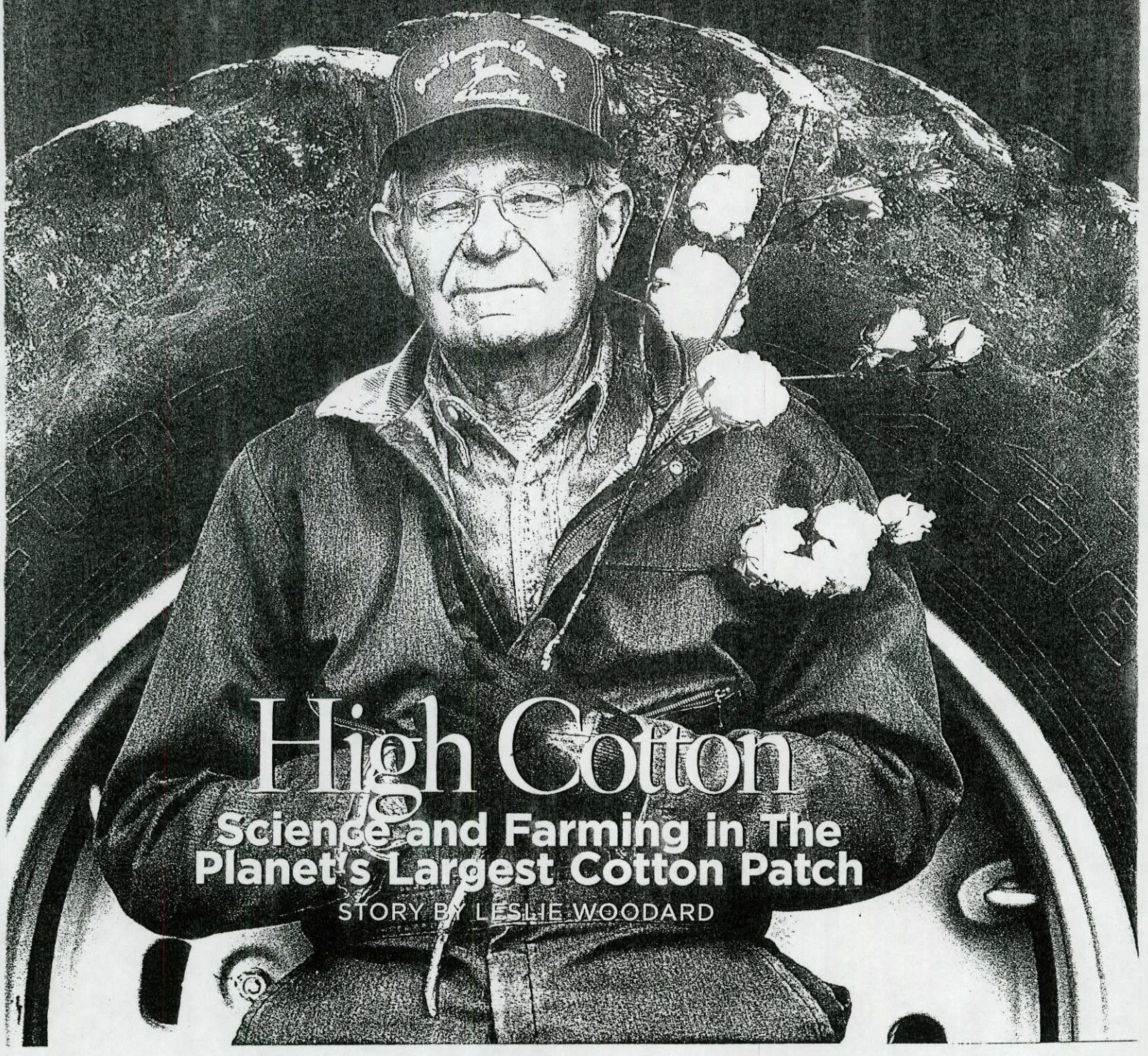
TEXAS TECH RESEARCH. WINTER 2003 VOLUME 11 NO.1



High Cotton

Science and Farming in The Planet's Largest Cotton Patch

STORY BY LESLIE WOODARD

VISTAS

TEXAS TECH RESEARCH.W

Each issue of **VISTAS: Texas Tech Research** (Library of Congress ISSN 1055-9159) reflects the goals, techniques, results and drama of research and creativity at Texas Tech. The magazine describes only a few of the many scholarly activities conducted at Texas Tech University and Texas Tech University Health Sciences Center. The magazine is published by the Office of News and Publications, Box 42022, Texas Tech University, Lubbock, Texas 79409-2022, (806) 742-2136. Text from **VISTAS: Texas Tech Research** may be reprinted without permission, as long as credit is given to Texas Tech. Please direct all inquiries concerning text and photography to the Office of News and Publications at the above address or e-mail to: vistas@ttu.edu. VISTAS is a member of the University Research Magazine Association. Texas Tech is committed to the principle that in no aspect of its programs shall there be differences in the treatment of persons because of race, creed, national origin, age, sex or disability, and that equal opportunity and access to facilities shall be available to all. Direct inquiries to the Office of Equal Employment Opportunity, 242 West Hall, Texas Tech University, Lubbock, Texas 79409-1073, (806) 742-3627. Persons with disabilities who may need auxiliary aids or services are requested to contact the Office of News and Publications. Copies of this publication have been distributed in compliance with the State Depository Law and are available for public use through the Texas State Publications Depository Program at the Texas State Library and other state depository libraries.

editor's note

WINTER 2003 VOLUME 11 NO.1

"IN THE HARD-SCRABBLE LAND THAT IS WEST TEXAS, farmers eek out a living by being the largest producers of cotton in the world. Scientists at Texas Tech are doing research in every area of cotton farming, aiding the primary economic engine of the region, and contributing knowledge to the world about this agricultural phenomenon. Here, the land and people are touched by the weather on a daily basis. Texas Tech researchers are working to predict the weather, to protect people from the destruction of wind and hail, and to make the weather work in the best interests of crops and farms. NASA and Texas Tech have had a long relationship in research as scientists here are helping to develop heat- and drought-tolerant plants that can be grown in space. NASA lately has reached out to Texas Tech engineers to solve problems of comforting the long-range flight missions. Other researchers are protecting our underground water source by helping to clean industrial toxins in the soil at the Pantex Nuclear Weapons Plant near Amarillo. Chemists and engineers at the Texas Tech Health Sciences Center are producing natural drug treatments for malaria, new uses for drugs to help former people with antisocial pasts and to develop cancer vaccines against breast cancer as well as helping to treat victims of domestic abuse. Research matters in our lives and studies at Texas Tech are helping to solve some of society's most pressing issues. Read on. — *Kippra D. Hopper, Editor*

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TER 2003 VOLUME 11 NO. 1

high cotton

)wine_online

BY TIFFANY TUBBS-BERRY

libations

of choice for many could become Texas wines with a new on-line course. Shakespeare's words can be applied to the Texas wine industry, as he wrote, "Good wine is a good familiar creature if it be well-used." Tim Dodd, Ph.D., director of the Texas Wine Marketing Research Institute at Texas Tech University, is fermenting years of research into a new online course that hopefully will be well-used, making Texas wine increasingly valued in a competitive market.

The institute was established in 1988, as part of the Department of Education, Nutrition and Restaurant/Hotel Management in the College of Human Sciences. "The mission of the institute is to foster the economic development and growth of the Texas wine and wine grape industry," explained Dodd. "The Texas Wine Ambassador online course is the next step to make our research available to the public as well as to our students who are interested in the food and beverage industry."

In the past seven years, the institute surveyed numerous Texas wine consumers and found that they were buying wine from other parts of the country and world because of the lack of knowledge about Texas wine, explained Dodd. "We want to find a way to educate Texans about the jewels in their own backyard," he said.

As grapevines twist and turn, the institute's researchers make their way through Texas regularly collecting and disseminating information concerning Texas wine and wine grape production, wine sales and wine consumption in Texas. The researches are examining winery tourism, wine sales to restaurants and supermarket sales of Texas wines. "After the research was complete, we found that in 2001 there were approximately 3,300 acres of vineyards and 46 wineries producing more than 1 million gallons of wine in Texas. We are fifth in the United States for the amount of wine produced each year," he said.

Dodd said that Texas has one of the best conditions for growing grapes because of the diverse climates. "Some people wonder why Texas has excellent conditions for grape growing. With different weather conditions all in one state, Texas has the ability to produce a variety of grapes," he said. "Some grapes require humid climates for growth, while others require a dry climate."

As Dodd discovered not only the lack of knowledge of the Texas wine industry but also the abundance of economic advantages to Texas wine, he began looking at different ways to educate Texans. "After presenting the option of an online course, the Texas Department of Agriculture approved a grant for us in January 2002 that will allow us to create the online course to educate anyone and everyone about Texas wines," Dodd said.

The course will be made up of five sections covering the history of the Texas wine industry, the process of juicing the wine, the economic impact of wine, grape growing and the wineries in Texas. "Each section will be informative and will lead up to a test, which if passed, will make students Texas Wine Ambassadors," said Dodd.

Like harvesting grapes, the online course also must be well-nurtured before produced. "In Fall 2002, we introduced the pilot program course to approximately 40 Texas Tech restaurant/hotel and institutional management students, to test the online course and its interaction with the students," said Dodd. "We found it to be very helpful to the beverage management course students."

The course soon will be available for anyone who wants to become a Texas Wine Ambassador. "We want to not only target students with the course but also Texas Restaurant Managers Association members and the general public."

As Dodd continues to research the Texas wine industry, he finds new facets everyday that will lead him to harvesting new Texas Wine Ambassadors. "This is a new technology that we must take advantage of, and we are excited about making Texas wine a familiar creature to everyone." ←


MODAFINIL

BY ANDREA WATSON

children

with cerebral palsy and their families face challenges every day, from dealing with tight, spastic muscles or seizures to the social stigma sometimes associated with the condition. However, through a discovery made by a Texas Tech University Health Sciences Center physician, one of those struggles may be lessened.

Daniel Hurst, M.D., a child neurologist at the Health Sciences Center, believes the use of a prescription medication for narcolepsy may be able to treat muscle spasticity in children with cerebral palsy. He has treated a small number of patients with the medication, modafinil, and has seen remarkable improvement in their muscles, he said.

Hurst said the initial discovery came about largely by accident. The initial patient who showed improvement on the drug was originally brought in for treatment of seizures and attention deficit disorder.

"Modafinil can be effective for ADD, but without the side effects of the traditional medications," he said. "So we started him on the medication to see if we could improve the ADD. The child had been taking the modafinil for a couple of weeks when he had an appointment to see an orthopaedic surgeon for a consultation before a surgical procedure on his ankles because he was walking on his toes. I received a call from the surgeon saying the procedure had been canceled because the child's muscle spasticity had improved so much he didn't need the surgery."

Hurst admits he was surprised about the improvement in the patient's condition, but there was no other reason for the change in the muscle condition other than the medication.

To verify the effectiveness of the modafinil on muscle spasticity, researchers in the Department of Neurology completed a pilot study in late 2001.

"We did the pilot study with 10 patients. We involved a physical therapist to evaluate the children's muscle stiffness. Each child was evaluated before they began taking the medication and after they had been on the medication for a month," he said. "Most children showed improvement in their muscles and in the speed at which they could walk. They also showed improvement in the distance they were able to walk."

Because using modafinil to treat muscle spasticity is a unique usage for the drug, the Health Sciences Center is considering the possibility of seeking a patent for the new use. The pilot study also has been published in the *Journal of Child Neurology*.

Hurst said another, larger study has been developed to further research on the effectiveness of the modafinil.

"We're fairly certain this study will prove the effectiveness of the drug one way or the other," he said.

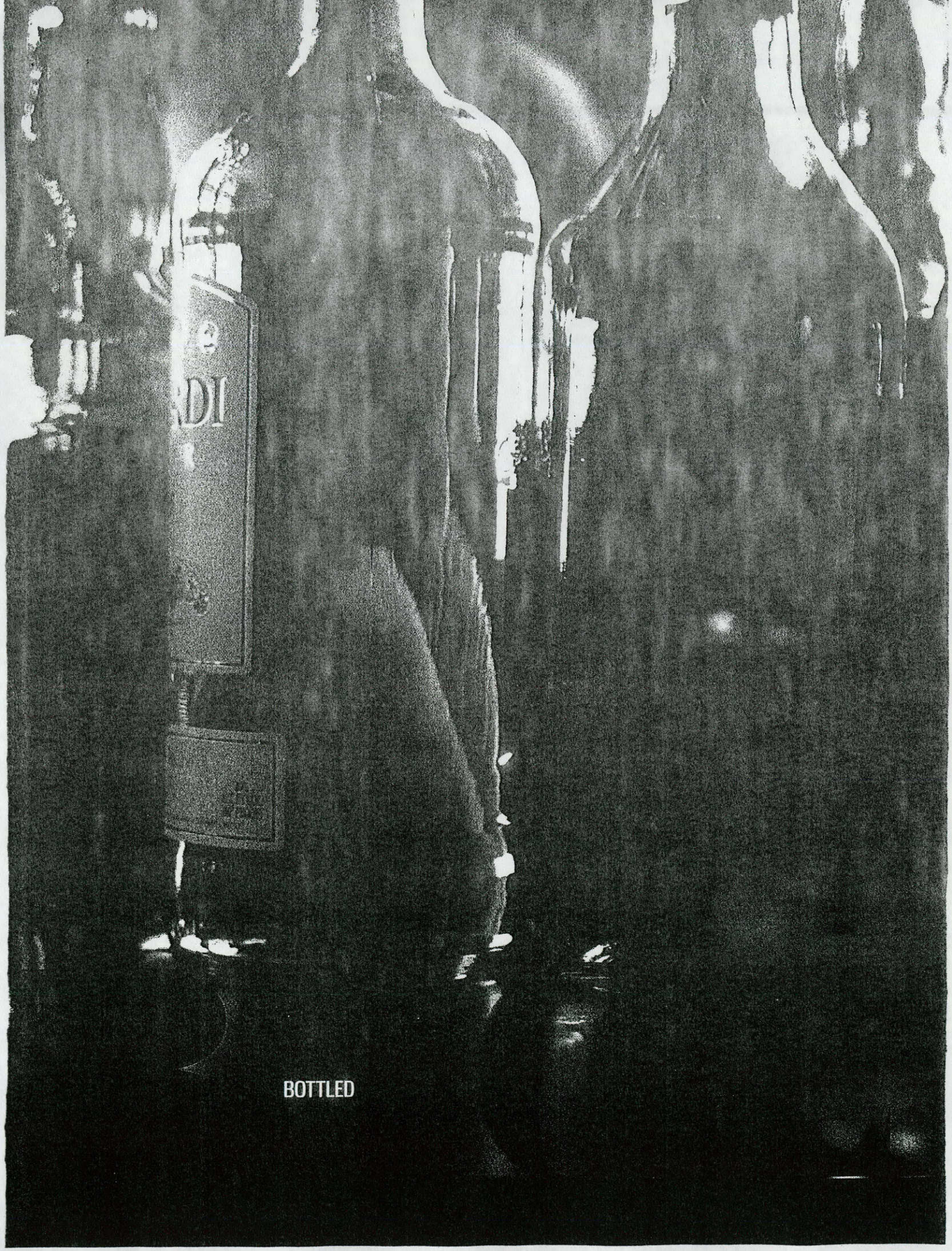
Hurst acknowledges that seeing these kinds of results from a drug that was developed to treat narcolepsy is unusual, but based on how the drug works within the brain, he is not especially surprised.

"Modafinil's action for treating narcolepsy is thought to be direct stimulation of certain brain stem centers," he said. "The areas of the brain stem stimulated by the drug are right next to the motor centers of the brain stem. One of those areas is related to muscle spasticity. We think direct stimulation of the brain stem is important because it's regulating those areas and telling them not to make the muscles as stiff."

He further said that stimulation of the lower centers of the brain stem as a treatment for narcolepsy is well understood, leading to the theory that the drug works in a similar fashion for treating the spasticity.

Overall, Hurst said, the most important part of this discovery is the possibility of improving the treatment options for patients with cerebral palsy.

"This could mean less surgery for these patients and less sedating effects than traditional treatments," he said. "From my standpoint, this medication has tremendous potential. This drug has the definite potential to improve the quality of life for many cerebral palsy patients." ←


BOTTLED

BY MARY HUDSPETH PETERS

violence

on the domestic front is thought of as a law enforcement issue by many. A couple gets into a fight, the police are called, and someone goes to jail. But with physical aspects, such as broken bones, and the emotional trauma, the issue really becomes a health matter.

Donna Scott-Tilley, R.N., Ph.D., assistant professor in the School of Nursing at Texas Tech University Health Sciences Center, has been researching the health aspects of domestic violence for several years and began her research by studying women who were victims of domestic violence. "When I got out in the field, visiting places such as Women's Protective Services (in Lubbock), what I noticed was that these women not only had actual health problems, many also suffered from depression. They were neglecting themselves, and many of their children had behavioral problems."

In these early stages of her research, Scott-Tilley talked to women who had been abused, and every woman in her sample suffered from depression. "These women all suffered from depression, and they had received no care or counseling from anyone. This validated to me that domestic violence is a health issue," she said. After that study, she immediately started working with Women's Protective Services to educate health care professionals about the needs of victims.

Scott-Tilley then began another level of research. She had seen the effects of domestic violence, so she decided to look further into the cause. "I wanted to find out what was happening with the men who batter and what we can do to not have them grow up to be batterers," she said. "There is very little research on why men grow up thinking they can hit."

She interviewed 16 men who were convicted of intimate partner violence who were going to the Batterers Intervention Prevention Program (BIPP). In Lubbock, first time offenders go into the program instead of going to jail. The men must pay for the training and follow a rigid set of rules. If they don't succeed in the program, they are then sent to jail.

Of those men, Scott-Tilley said, she was surprised to find that only about half had previous experience with domestic violence. "Among these men, those who said they experienced or witnessed violence in the home growing up was not that common," she said.

Scott-Tilley found, however, a strong correlation between alcohol and/or drug use and domestic violence. "The alcohol and drugs often gave the couple something to fight about, whether it was because of the money spent on the habit, because one of the partners was gone all the time, or because the couple was using together and getting into fights," she said.

One of the important discoveries in the course of her research was that the couples involved in domestic violence did not possess basic problem-solving skills. "The majority of these couples did not know which lines you don't cross, they don't know how to solve basic conflicts," Scott-Tilley said. Ten of the 16 men said they were just so mad they didn't know what to do. They would find things to tear up so they wouldn't hit someone because they just didn't know how to control their anger, she said.

Scott-Tilley said this explains why placing men in batterers' intervention programs is more effective than just sending them to jail where they may become more violent. In these programs, they are able to learn coping skills. She said women also are in need of the same training in which they can learn conflict resolution and anger management skills. "All family members are in need of these skills. If the men learn conflict resolution skills but their partners haven't learned them, one of the basic problems is still present," she said.

Scott-Tilley said she believes based on her research that more money should be spent on prevention programs, like dating violence and drug and alcohol awareness programs. The current practice is to place most of the resources into shelters and programs that deal with violence after it has occurred. "Ultimately, I would like to see prevention programs that are so effective, they eliminate the need for shelters," she said. ←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Rush composition

students are wanted for a bright approach to freshman composition courses. For more than 15 years, Fred Kemp, Ph.D., associate professor of the Department of English, has been searching for ways to improve the way composition is taught in English classes on college campuses. To him, English courses, especially for freshman college students, have been less engaging and more subjective for students. Rather than spending more time composing essays, Kemp said students have to endure listening to "how-to" lectures on writing. To help students play an active role in learning the art of writing, Kemp has created software that replaces the traditional lecture format with an interactive online class. This fall, first-year composition courses English 1301 and 1302 have evolved from a lecture-style writing seminar class to a Web-based, hands-on writing course that gives students the opportunity to practice the craft of writing instead of hearing lectures about the craft.

"Grading composition is inherently subjective," he said. "Different readers can respond to the same piece of writing differently, especially readers with varying levels of grading experience as we have among our graduate students. The program we used for the first-year composition classes clarifies the criteria of effective writing and emphasizes consistency in applying those criteria."

Under the new curriculum, students meet once a week with a classroom instructor. During the class, instructors coach students on their writing skills. For their assignments, Kemp said students submit papers via the Internet using his program, Interactive Composition Online or ICON. Essays that are submitted under ICON are edited and graded by document instructors who are graduate students who review students' work. Unlike the classroom instructors, document instructors do not work closely with nor do they know the students personally, so the document instructors, therefore, are not compelled to grade the students based on their personalities, but on their performance, Kemp said. Because the document instructors anonymously evaluate the students' work, Kemp said objectivity is restored in composition classes.

"This program is revolutionary in that it relieves teachers of the burden of grading and gives them the opportunity to coach students on their writing skills," he said. During the 2002 spring and summer semesters, the Department of English pilot-tested the ICON program with several sections. For the spring semester, three classroom instructors and seven document instructors taught the courses while two classroom instructors and four document instructors taught sections for the summer session classes. Under the new course, Sam Dragga, Ph.D., professor and chairperson of the Department of English, said students were able to receive more immediate feedback on their papers from instructors. Dragga said students were very receptive to the revamped curriculum for the course.

"With the World Wide Web and wireless communications, you do not have to be necessarily in the classroom to receive instruction," Dragga said. "By using the technology that is available to us in innovative ways, we are freeing students from having to be in a classroom."

With the introduction of the new program, Kemp said he anticipates receiving some mixed responses to the revamped curriculum for the freshman-level classes. He said some students will embrace the changes to the course because they feel a sense of comfort in knowing that their papers are graded fairly by non-biased instructors. Other students may prefer their instructors to grade their compositions rather than an unknown reviewer. Under the new curriculum, Kemp said, some teachers will rejoice at the idea of not being overwhelmed with the responsibility of grading mounds of term papers while other instructors will dislike having their students' essays evaluated by another instructor.

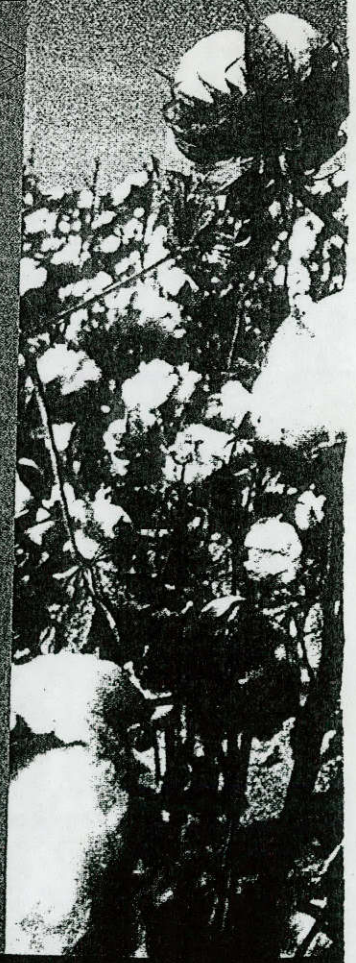
By having a more interactive composition class, Kathy Northcut, a doctoral student in Technical Communications and Rhetoric of Lubbock, said she was able to engage students in collaborative work efforts, such as group activities, because she spends less time presenting lectures to her students under the new English courses. Northcut, who first taught the class during the summer, said students can devote more outside time to reading and writing assignments because time was limited for in-class instruction for the course. While teaching the class, Northcut said she could give her students feedback that was consistent with textbook material and the criteria for the class.

"No one learns to write by listening to someone talk about writing," Northcut said. "The students are able to practice working with ideas and concepts in small groups and individually a lot during the online class."

high cotton

STORY BY LESLIE WOODARD

photographs by artie limmer



Like the strong smooth weave of new denim jeans, Texas Tech University's cotton research is woven indelibly into the cotton industry's past, present and future. From one small seed comes a plant that is integral to the fabric and fiber of our daily living.

The cotton we know today has evolved over centuries from Southern plantations to a multi-billion-dollar worldwide industry. Fibers are longer and stronger. Seeds are more heat-, cold- and drought-tolerant. Harvesting is faster and more efficient. Processing is quicker and more precise. Many of the advances in cotton technology and research are attributable directly to work done at Texas Tech University, work that resulted from visionary foresight by the university's founders.

In 1923, the founding fathers wrote into the charter of Texas Technological College that the school would study cotton and textiles. The second building constructed on campus was the Textile Engineering Building. Today, Lubbock and Texas Tech are in the center of the world's largest cotton patch. The 125-mile radius surrounding Lubbock produces about 20 percent of the country's cotton crop, which is about 5 percent of world cotton production. Texas High Plains' cotton has moved from use in low-end production to being the preferred type of cotton for some particular kinds of manufacturing and for popular fabrics such as denim. Lubbock is home to the largest concentration of cotton research infrastructure anywhere.

Research and subsequent practical applications coming out of the College of Agricultural Sciences and Natural Resources are helping cotton producers and others involved in the cotton industry to grow crops more efficiently and to make better-informed marketing decisions. Texas Tech's cotton research is even supported by the Department of Defense to create improved fabrics for protective clothing.

A large part of the history of Texas Tech's cotton research comes from its International Textile Center, an auxiliary of the university. The center is charged with conducting research that will lead to greater use of cotton and other natural fibers, and with assisting the textile manufacturing industry in the efficient use of these fibers. The International Textile Center serves as a research, evaluation and consultation center for the global textile industry.

Beginning in the late 1960s, Texas Tech's International Textile Center played an essential role in the research, development and evaluation of High Volume Instrument technology used to measure the essential properties of cotton fibers. Since 1992, the United States Department of Agriculture has used these systems exclusively to evaluate the entire U.S. cotton crop. The technology continues to evolve, as Texas Tech researchers and industry partners study experimental measurements to enhance the information that the instruments gather.

Texas Tech's Department of Plant and Soil Science also continues its ongoing exploration of ways to make cottonseeds more stress-tolerant and to make fibers longer and stronger. Dick Auld, Ph.D., department chairperson and professor of plant genetics, says a lack of genetic variability exists in cotton, which makes it necessary to search for and identify new genes for specific cotton traits that would increase the cotton's quality or value.

One project Auld and other researchers are working on is to reduce the amount of oil the cottonseed produces. "The plant expends twice as much energy to produce oil as it does to produce cellulose, or fiber. If you reduce the amount of oil produced in the seed, more of the energy is available for fiber production," Auld said.

Another study in Auld's cotton breeding program involves trying to reduce the maturity time of certain types of cotton. "The Texas High Plains has a considerably shorter cotton growing season than other parts of the state or the South," Auld said. "We are working on breeding a line of cotton that has a shorter maturing period. The fiber will be every bit as long as types of cotton grown in other parts of the state."

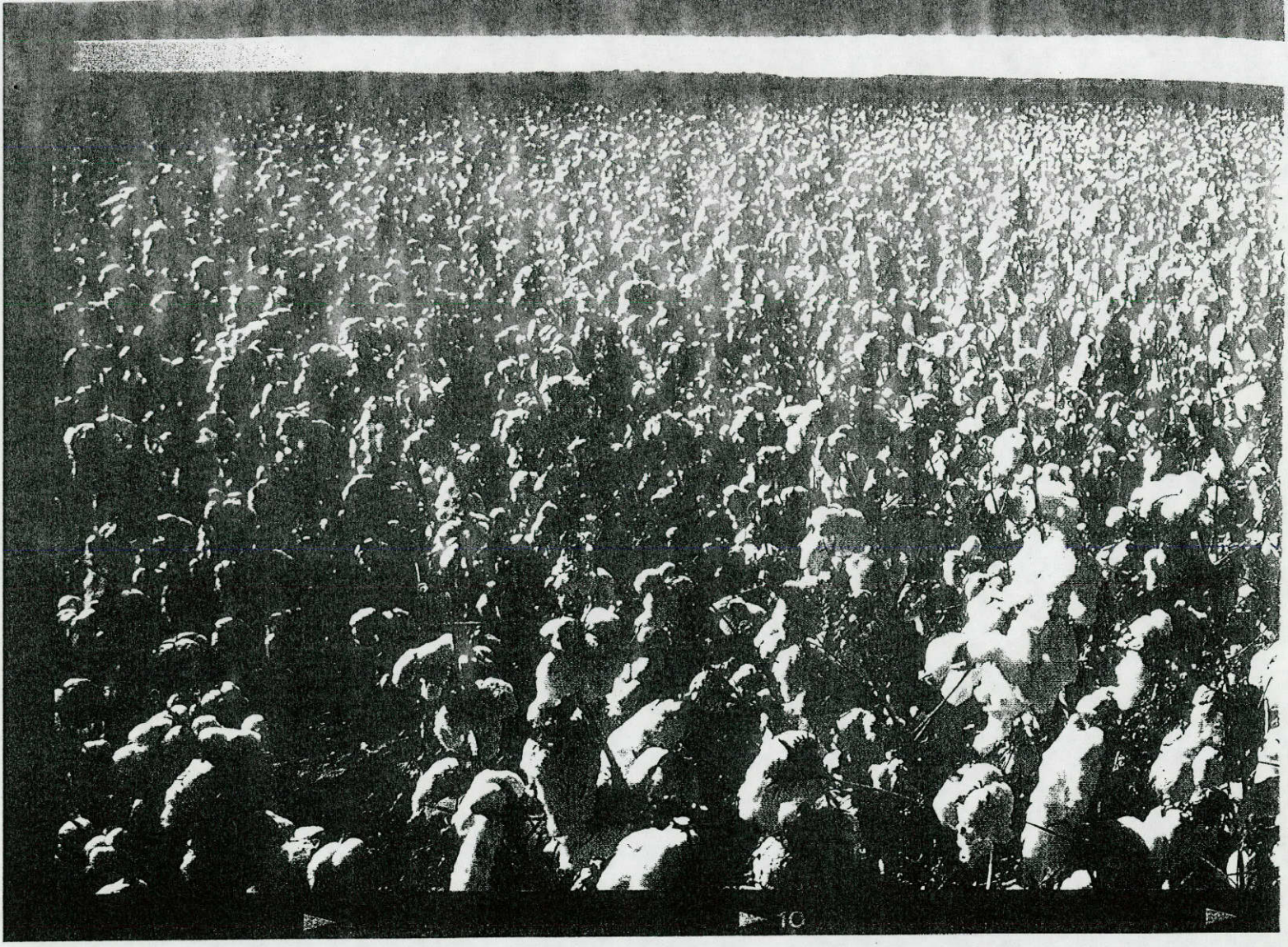
Auld's preferred method of genetic manipulation is chemical mutagenesis, meaning, applying a chemical to the seed to change the DNA structure, which randomly changes the genes involved. Auld says with this method, if a researcher finds even one desirable trait, the process is extremely cost-effective. In fact, he said, by this process, his researchers found a gene that when expressed in a certain type of cotton, increased the fiber length two-tenths of an inch.

Auld's cotton genetics methods do, however, differ greatly from the methods of genetic engineering used by molecular biologists at Texas Tech, such as Randy Allen, Ph.D., a professor of biological sciences and plant sciences, and co-director of Texas Tech's Center for Biotechnology and Genomics, specifically in plant molecular biology.

"One of our goals is to make cotton that establishes well in colder temperatures, yet can yield well in dryland conditions," Allen said. "One of the problems with traditional breeding is that stress tolerance usually comes at a cost to the yield. So we approach the problems transgenically, by introducing genes from other plants that carry the desired trait," Allen said. "We're looking for genes that will break the linkage between yield and stress tolerance. Our approach is to increase the expression of genes that protect cells from damage caused by oxygen radicals. Working with plant physiologist A. Scott Holaday, Ph.D., we have found that transgenic plants that express certain antioxidant genes maintain higher levels of photosynthesis after exposure to stress and in preliminary field tests, these plants appear to be more productive than normal plants under dryland conditions."

Allen says, like stress tolerance, fiber length and yield also are opposed. "Anytime you breed for longer fiber, you get less yield. The breeders know this. So, as in our fiber quality research, we're looking for ways to break down the linkage between fiber length and yield."

What Allen has done is try to identify one or two genes that specifically affect length, then, take a cotton variety with typically short fiber, introduce these genes, and see if it results in longer fiber. What he found is that cotton plants do not express the optimum amount of an enzyme called xyloglucan endotransglycosylase, or XET, which when expressed, allows the



cell walls of cotton fiber to expand and stretch, resulting in longer fiber.

"When we overexpress this gene, we get a consistent 15 to 20 percent increase in fiber length in the variety we're using."

Allen says researchers haven't done extensive yield tests on the variety, but he believes a chance exists that they will be able to break the linkage between fiber length and yield. The use of the gene has been patented by Texas Tech and Toyobo, the Japanese textile company that funded the research.

Commercializing any genetically modified plant, Allen says, is an extremely expensive proposition, and is becoming more so every day. Because of the prohibitive cost of marketing a transgenic line, Allen says, Texas Tech's approach has to be to license the technology to a seed company that has the capital to see the process through. "We have great technology, and we are making strides in seed tolerance and in fiber quality. The question is, whether commercializing these improvements is economically feasible," Allen said.

However, advances in cotton quality will help very little if the soil does not have the proper composition for successful cotton production. Texas Tech's Plant and Soil Science Department is linking farming to modern satellite technology to produce crops more efficiently, by studying precision agriculture practices.

Precision agriculture uses global positioning satellite systems to assist farmers in potentially increasing profits by redistributing field inputs, such as fertilizers and pesticides for more efficient use. Cary Green, Ph.D., associate professor of soil chemistry, says fields are not necessarily uniform and may not need to be treated as such.

"Traditional agriculture treats crop fields uniformly with respect to production inputs," said Green. "However, soil properties can vary in time and space and affect crop production. As a result, uniform application of agricultural inputs may result in over-application in some areas and under-application in others. Precision agriculture technologies are available that allow variable application of crop inputs within a field."

According to Green, field variables are anything from moisture to soil fertility, to pathogen elevations to weeds and insects. Fields with little variability in these factors would not benefit significantly from the use of precision agriculture.

In precision agriculture, satellites are used to locate and plot areas where researchers then take samples. These samples are sent to a lab to determine

soil fertility and other factors. A yield monitor can be used to record yield from different areas of the field, and combined with the global positioning system information, can provide locations of high and low yield.

Green has been conducting research on two irrigated cotton fields near Lubbock since 1998. For one of the fields, four potential management zones were identified, based on yield and a combination of soil parameters. Those zones can serve as basic management zones for further variable application experiments.

Precision agriculture can potentially affect profits in two ways, said Green, "One, by increasing yield, and two, by decreasing inputs in areas where they're not needed."

Jerry Brightbill, of Brightbill Farms in Plainview, has used precision agriculture practices for three years, and has seen proven success in his 4,000 acres of cotton.

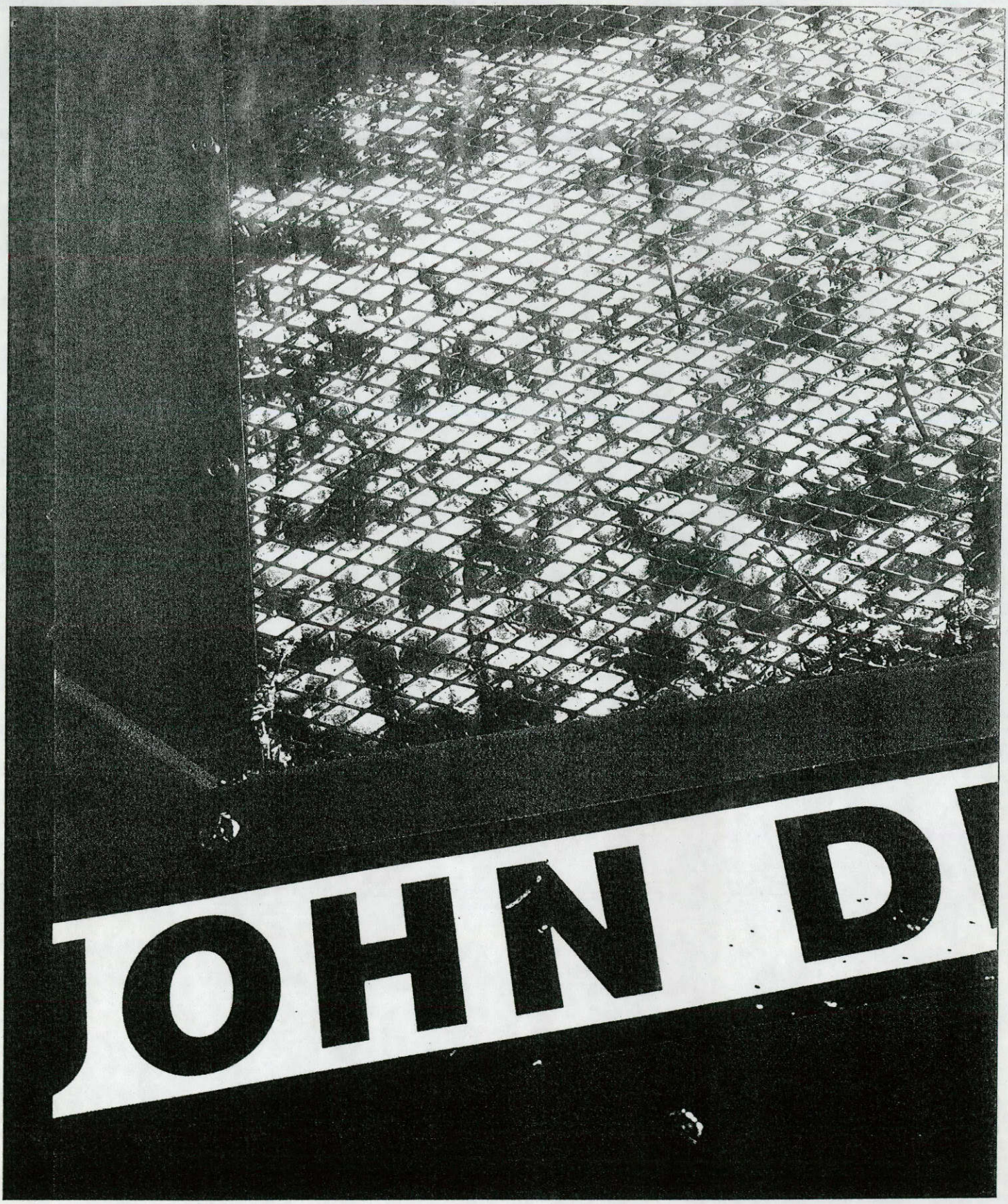
"It has reduced overall chemical inputs by 3 to 5 percent. However, it has reduced the rate of Roundup usage by 50 percent," said Brightbill. "The field computer maps where we have sprayed and where all of the hazards in the field are. Therefore, we can spray at night, and a 50 percent rate of Roundup will do better than a full rate in the daytime. It has given us the ability to find and treat areas of each field in different ways."

Brightbill says his farming operation has definitely profited. "In chemicals alone it has paid for itself and then some. Now if we can prove the yield increases by properly matching crop need to inputs, we will be able to add additional profit to the operation."

Like Green, Texas Tech's other cotton researchers have strived to make practical applications of the information they gather. Nowhere is this more evident than in the Department of Agricultural and Applied Economics. Don Ethridge, Ph.D., chairperson of the department, believes if producers cannot sell their cotton effectively, there is little point in producing the crop in the first place. "It doesn't really matter what technology or innovations or strides are made in other aspects of cotton production if the market for cotton isn't there," Ethridge said.

His part of the solution has been to take difficult economic principles and formulas, derived from research, and make them available to cotton producers via several fairly simple interactive Internet tools.

One of the departments' first advances was to initiate the Daily Price Estimation System. The idea was conceived nearly 10 years ago, and the last six years, information has been available online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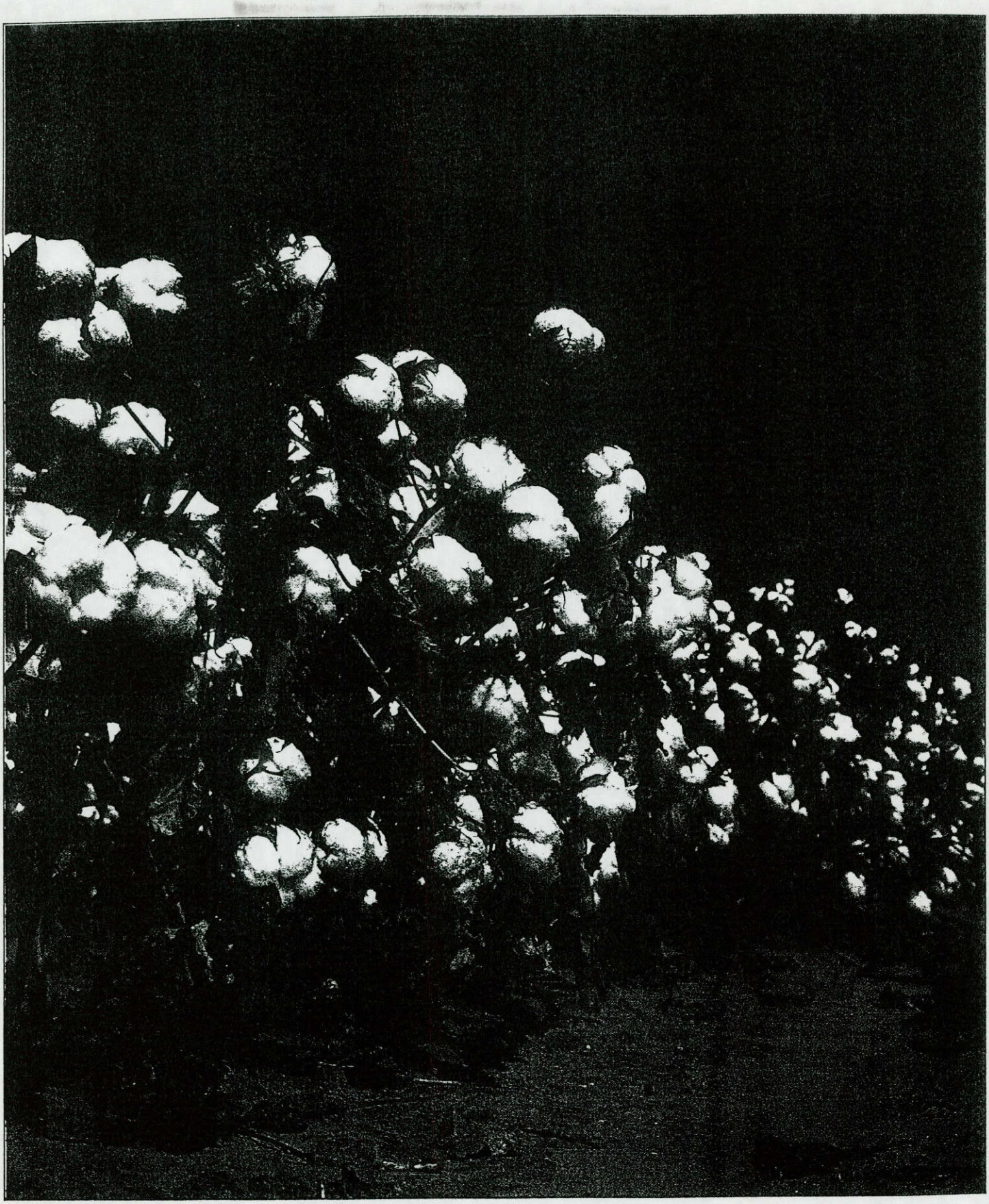

WINTER 2003 VOLUME 11 NO.1

Today, flying over the South Plains of Texas, one can see the quilted patchwork of irrigated and dryland farms growing cotton - the region's mainstay economic industry. Lubbock and Texas Tech are in the center of the world's largest cotton patch.

at *http://www.aeco.ttu.edu/DPES/*. This system estimates the day's prices for all qualities of cotton, based on what happened in the market that day for cotton with specific qualities and characteristics.

"In such an unpredictable market as the cotton market is, there is a need for reliable and timely information. The availability of more and better information in a marketplace creates a more pricing-efficient market, and price instability is held down," Ethridge said.

According to Ethridge, governmental approaches and procedures for measuring and reporting prices in the U.S. cotton industry have not changed appreciably over the last century, even though information handling and econometric technology now present countless new possibilities for measuring and reporting those prices. The promise of these possibilities, more than nine years ago, led Ethridge to pursue his notion of the Daily Price Estimation System for the cotton industry.

The use of the DPES in cotton price estimation can add two primary things to price reporting – objectivity and reliability. The Daily Price Estimation System allows a more comprehensive and rigorous analysis of price-quality relationships, while enhancing the speed at which prices can be analyzed and reported.

Ethridge explained that econometrics, the centerpiece of the system, operates within the realm where economic theory, math and statistics collide. Econometrics is a descriptive term for a general approach to estimating and quantifying economic phenomena.

Sukant Misra, Ph.D., associate dean for research in the College of Agricultural Sciences and Natural Resources and researcher on the DPES project, pointed out that in no way are the researchers predicting or forecasting prices in the cotton market. "We are quickly and accurately reporting and analyzing what the markets are really doing and have done," Misra said.

With the information generated by the DPES, and funding from Cotton Inc., Misra's researchers recently developed the Cotton Price Calculator tool, available at *http://www.aeco.ttu.edu/CER-Institute/PriceCalculator/default.htm*. "The purpose of the DPES cotton price calculator is to allow users to calculate a specific cotton price based on the premiums and discounts generated by the Daily Price Estimation System," Misra said. Two estimation methods are available: One estimates prices using the previous week's average premiums and discounts generated by the DPES; Method two estimates prices using the year-to-date average premiums and discounts generated by the DPES.

"We do not advise a buyer or a seller to buy or sell based on one day's market results. That's why the calculator gives them a choice of using the previous week's information, or the year-to-date information," Misra said. "Really, the bottom line is that prices vary so much with quality, this tool helps the buyer or seller form realistic price expectations about a certain group of cotton, based on what the market already has seen."

Another tool available online from Texas Tech's Agricultural and Applied Economics Department is the Cotton Harvesting Cost Calculator, at *http://www.aeco.ttu.edu/CER-Institute/CottonHarvesting/default.htm*, also funded by Cotton Inc. This particular site, also developed by Misra, is an analytical model converted into an interactive program.

"This particular program allows producers to input information into the calculator and discern what type of harvesting equipment might be more cost effective for the acreage and yield of that particular crop," Misra said. A producer can look at cotton strippers or pickers, two-row, four-row, six-row or eight-row, with or without cleaners, and come out with a suggestion of which harvesting technology would be more efficient for the particular cotton operation. Producers who already own a particular piece of equipment also can use the harvest calculator to estimate their harvest costs.

A third Web-based tool, developed by Misra and research partners at Agricultural Research Services – United Stated Department of Agriculture, is GinQual, a ginning quality simulation model. The site, at *http://www.aeco.ttu.edu/CER-Institute/newginqual/default.htm*, was funded in part by the Cotton Production and Processing Research Unit of the United States Department of Agriculture – Agricultural Research Service. This site simulates the changes in cotton quality as it moves through the ginning process. On this site, the ginner can specify a certain variety of cotton and other parameters to track changes in quality and yield. There are seven fiber qualities and net cotton weight that are considered.

"The ginners are the primary users of this program," Ethridge said. "It allows the ginner to simulate the cotton's moving from various stages of lint cleaning, to see what happens to the weight and other characteristics."

Larry Nelson, of Edcot Gin in Edmonson, says he is very satisfied with the effort Texas Tech's Agricultural and Applied Economics Department is making in bringing information and tools to end users in the industry. "I'm very pleased with what's coming out of their research. These tools can be useful if used to their potential," Nelson said.

Finally, from the Cotton Economics Research Institute, comes a project led by Emmett Elam, Ph.D., which is still a work in progress. The Cotton Wizard, when complete, will be an interactive tool to help producers with decisions on variety selection. Producers will be able to input information on rainfall, irrigation, soil type, location and other information, and retrieve suggestions on what cotton varieties might be cost-effective for that set of information. Theoretically, the Cotton Wizard will be able to calculate expected net returns for any number of varieties, and also give variability on those returns.

Shawn Wade, marketing director for Plains Cotton Growers in Lubbock, says the Web-based tools developed by Texas Tech are becoming more and more useful to producers, ginners and others involved in the cotton industry.

Many of the world's advances in cotton technology and research are attributable directly to work done at Texas Tech University, work that resulted from visionary foresight by the university's founders, who wanted the school to study cotton and textiles.

"As producers look more closely at the decision-making process, these economic tools are extremely helpful," Wade said. "It is critical for producers and ginners to have the most information possible, whether it is for harvesting, marketing or ginning. These are frontline types of tools."

Wade says getting the word out about them is crucial. "The more producers become aware of the availability of these tools, and how they can use the information the tools provide, they will become a much more widely used resource for those producers."

Ultimately, Ethridge said, developing Web-based tools is a way to get Texas Tech research into the hands of those for whom it will benefit most: the producers and others in industry. "The building of the Web programs is not research itself, but it is a way to present analytical research to a user in a user-friendly fashion. How many ginners are going to sit down and do all these calculations to figure out what's happening in their ginning process? This way, they can go to the Web anytime they want, and run multiple scenarios."

From the seed through the entire production process to end use, Texas Tech is involved in identifying more and better uses for cotton and cotton by-products. Texas Tech animal science researchers also are looking at the possibility that incorporating cottonseed into cattle feed can reduce the instances of *E. Coli* in feedlot cattle. Mindy Brashears, Ph.D., and Mike Galyean, Ph.D., are studying what happens to levels of *E. Coli* 0157:H7 in cattle when they are fed cottonseed. Cottonseed is commonly fed to dairy cattle as a good source of protein and fiber. However, feedlot cattle have not had access to this diet on a regular basis because of high use by the dairy industry. Brashears' and Galyean's pilot study involved two dozen cattle divided into two pens; one fed a standard diet and the other, the whole cottonseed mixed into the feed. The animals were fed the cottonseed within 28-42 days of slaughter, and were tested for E. Coli every 14 days. After 28 days of feeding, 66 percent of the control animals tested positive for *E. Coli*, whereas only 25 percent of the animals fed the cottonseed tested positive. In the spring of 2003, the two researchers will perform a full-scale test on 120 to 130 animals for 120 to 180 days. They will be able to test over the entire feed period, as they will buy the cattle at a fairly light weight. Galyean says particular components of the whole cottonseed, like the oil or fiber, may specifically affect the *E. Coli* levels. Therefore, Galyean's and Brashears' spring project also will test the effectiveness of individual components of the seed. "The components of cottonseed are the fiber (hulls and lint), the protein, which is what cottonseed meal consists of, and the oil. We will feed these components mixed together in the diet and see how this mixture compares with whole cottonseed," Galyean said.

Aside from cottonseed, Texas Tech researchers also are studying new uses for the fiber itself. Seshadri Ramkumar, Ph.D., a research associate in the Admiral Elmo R. Zumwalt Jr. National Program for Countermeasures to Biological and Chemical Threats, at Texas Tech's Institute of Environmental and Human Health, is working on incorporating cotton and other natural fibers into protective fabric, used for such things as chemical protective suits, to improve comfort and breatheability. Steven Presley, Ph.D., the research coordinator for the Zumwalt program, and an associate professor in Texas Tech's Department of Environmental Toxicology, said this particular research comes at a time when there is a heightened awareness of biological and chemical threats to the United States and around the world.

"Protective fabric technology is something we're looking at in response to a need by the Department of Defense for lightweight protection against chemical, biological and ballistic threats," Presley said.

Ramkumar's research involves non-woven materials, and utilizes a state-of-the-art H1 technology needle loom. Texas Tech is the first and only facility in the United States to have this technology. Blends of cotton, wool, mohair and synthetics have been successfully manufactured into non-woven substrates of different weights.

"A substrate is a flat fabric material that comes out of non-woven machinery, that hasn't been made into a garment," Ramkumar said.

In regard to the protective fabric research, he said the aim is to develop a protective composite substrate, out of both synthetic and natural materials, to deliver protection in chemical warfare. "Cotton can be a component of this, to add comfort properties to the fabric," he said. There are other entities researching protective fabric, but, he said Texas Tech is the only one using non-wovens in the process. Ramakumar recently has filed a patent application on the method to develop chemical warfare protective substrates through the Institute for Environmental and Human Health.

Texas Tech's non-wovens laboratory also is capable of developing heavyweight composites, which will bring more value to cotton by developing high-value products such as upholstery, carpet, cushion pads and absorbent products - items that do not typically contain cotton. Ramkumar said that the needlepunch technology is very versatile and cost-effective for cotton, as the process skips the spinning and weaving steps of the fabric manufacturing process.

"The overall goal is to develop 100 percent cotton non-woven substrates that will have a variety of applications," Ramkumar said.

Real-life applications and information gleaned from cotton research have been part of the fiber of the university from its very beginning. From the development of HVI technology many years ago, to the development of biosafe fabrics for defense purposes, Texas Tech's cotton and related research has come a long way. Texas Tech will continue to lead the way, staying on the cutting edge of investigation and exploration in the global cotton industry.

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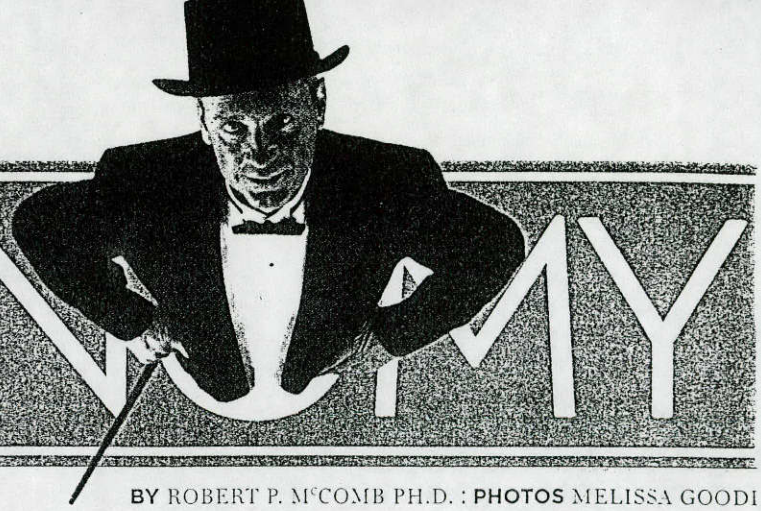


BY ROBERT P. McCOMB PH.D. : PHOTOS MELISSA GOODI

TEXAS TECH IS PLACING GREATER emphasis on its regional economic development efforts. Is this an appropriate mission for Texas Tech University? Faculty steeped in a tradition of teaching, research and professional service, whose time is already subject to competing demands, may not readily embrace this role.

A widespread perception is that economic development is only business development. Too often, the metric used to evaluate economic development efforts is "number of jobs created or retained." Of course jobs are important. Healthy economies create desirable jobs, expand employment choices for existing residents, and attract new residents. But such a simple view ignores the true complexity. Successful economic development looks upstream and across the community's landscape. Sustainable, prosperous economies and businesses both enable and depend on significant investments in human capital and social infrastructure, effective local government and leadership, and cultural and recreational amenities that contribute to a high quality of life.

Regions that fail to provide a suitable economic environment confront an unattractive future given today's highly competitive interregional context. Lubbock, the largest population center in Northwest Texas, has been holding its own on most counts. Much of West Texas, though, is lagging. The 2000 census showed that many of the counties in West Texas actually lost population and workforce in the 1990s. While precise data are difficult to obtain, a significant share of the growth in Lubbock-area population appears to be coming from intra-regional in-migration. From a regional perspective, this is a one-time, zero-sum game. Although the decline of smaller communities can be observed across America, small communities characterize West Texas, increasing our exposure to the problem.

All residents of our region have a stake in the success of the regional economy. Many people also would agree that the futures of most state universities are linked to the health of the local and regional economies around them. Texas Tech is probably in this group. Not only do we rely on West Texas for a full one-third of our student enrollment, our ability to compete for increasingly scarce fiscal resources for higher education will be hindered by our region's declining political clout.

Texas Tech always has made important contributions to the Lubbock-area and regional economies. Certainly, our primary missions of providing higher education and conducting research have direct and indirect economic impacts. Texas Tech is a major employer and a principal element in the social and cultural fabric of our region. Its very presence attracts activities, businesses and creative people that otherwise would not be here. It is indeed more than a coincidence that a major research university is always present in the cities and regions that have enjoyed the most dynamic economies over recent decades. Universities are at the core of technology business clusters that drive entire regional economies.

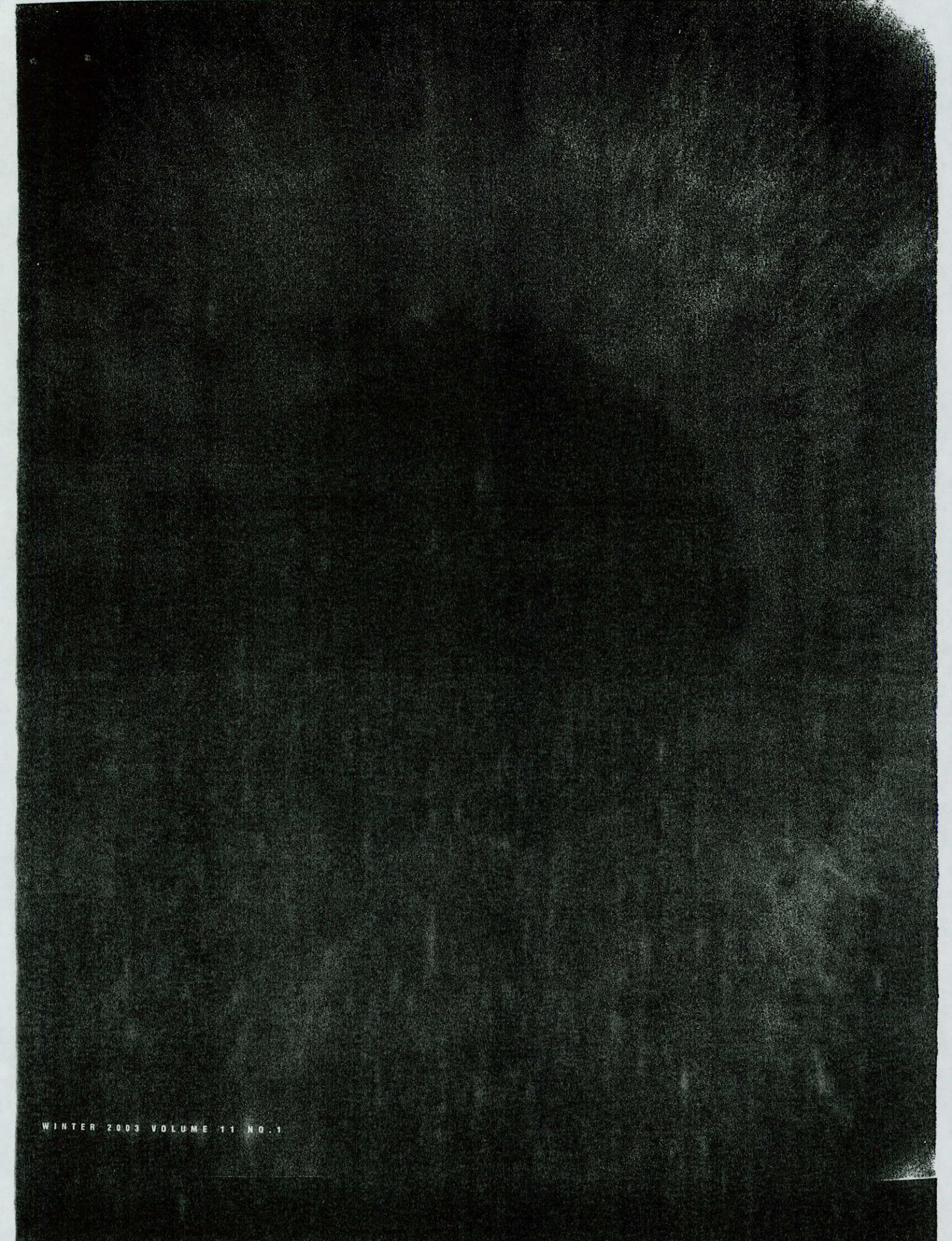
Precisely because universities play such a key role in the knowledge and information intensive economy of this century, Texas Tech University has a particular responsibility to West Texas. We are the only research institution in Texas west of I-35, and thus, the only institution that can play the role of growth pole. And while state financial support for higher education continues to decline as a share of Texas Tech revenues, more is asked of us as a state agency. The Legislature insists that Texas state universities be direct players in regional economic development, that we open wider our doors to promote greater leverage of the state's investment.

Achieving success in this role is more than just a question of presence. It calls for broad-based institutional receptivity and commitment to regional deployment of university resources and assets.

For many disciplines, effective leveraging of Texas Tech to encourage regional economic development is closer to our normal course of academic activity than we may think. It is difficult to point to a discipline that cannot contribute to enhancement of the regional economic environment. By adding a service learning component to course syllabi, pursuing opportunities for technology transfer, or by making minor adjustments to applied research agendas, faculty can have an impact. Of course, Texas Tech has to facilitate and encourage faculty involvement in regional endeavors. This will come down to providing appropriate incentives and recognizing effort.

Economic development should seek to build and sustain a higher quality of life for all residents. I believe it shares this goal with higher education.

ROBERT P. MCCOMB, PH.D., IS THE ASSISTANT VICE PRESIDENT FOR ECONOMIC DEVELOPMENT AT TEXAS TECH UNIVERSITY.



WINTER 2003 VOLUME 11 NO.1

months without

contactsolution

ANDREA WATSON • PHOTOS ARTIE LIMMER

worrying about
and disinfecting

Ted Reid, Ph.D., and Steven Mathews, O.D., Ph.D., rtment of Ophthalmology and Visual Sciences, and Julian Spallholz, Ph.D., a professor of nutrition in the College of Human Sciences at Texas Tech University, are working to determine if coating contact lenses with selenium will make the hassle of daily cleaning unnecessary.

"The coating is only one molecule thick," Reid said. "It's not something that can affect the clarity of the lens or even be noticed by the wearer. The coating is a permanent part of the lens."

The coating is designed to keep bacteria from accumulating on the lens, causing biofilm formation, which causes a major class of eye problems for contact lens wearers.

"Bacteria are constantly floating around looking for places to attach themselves," Reid said. "The problem is that when they attach themselves, they grow and form these films that are very resistant to antibiotics and even bleach. These films take on a tissue-like structure. One layer attaches to the lens and then the next layers form a tissue-like structure which is finally covered with a layer that acts like a skin. It's this tissue or film that causes the wearer to have problems with their lenses."

Some of these bacterial biofilms also can be very dangerous because the bacteria can produce toxins that damage the cornea, often leading to ulcers and infections, which is why Reid and Mathews believe the selenium also will help make the lenses safer.

"That may be the primary benefit," Mathews said. "Evidently the selenium either sheds the bacteria or it kills it. Either way, if the material doesn't allow the biofilms to form, it will reduce the problems some wearers have with acute red-eye reaction or infections. These problems are all about bacterial load and if the coating reduces that bacterial load, then it will make it less likely that these conditions can develop. On its own, a healthy eye can fight off small numbers of bacteria very effectively, but a large number of bacteria can create their own environment and that makes them very difficult to fight off."

For decades, selenium has been recognized as an essential element, necessary for the body to function properly, but its medical uses have only been recognized within the last 20 years. Previously, selenium's main applications were commercial in nature, from being used to transfer images within copiers to tinting auto glass.

Spallholz, who has been researching selenium's effect on cells for more than three decades, believes the coating is effective because it kills the bacteria.

"My original interest was in attaching selenium to antibodies to use as drugs," he said. "These experiments showed that the selenium could kill cells. The selenium coating on the contact lenses works the same way. The selenium acts as a catalyst on the surface of the lens and helps create a molecular barrier to the growth of cells."

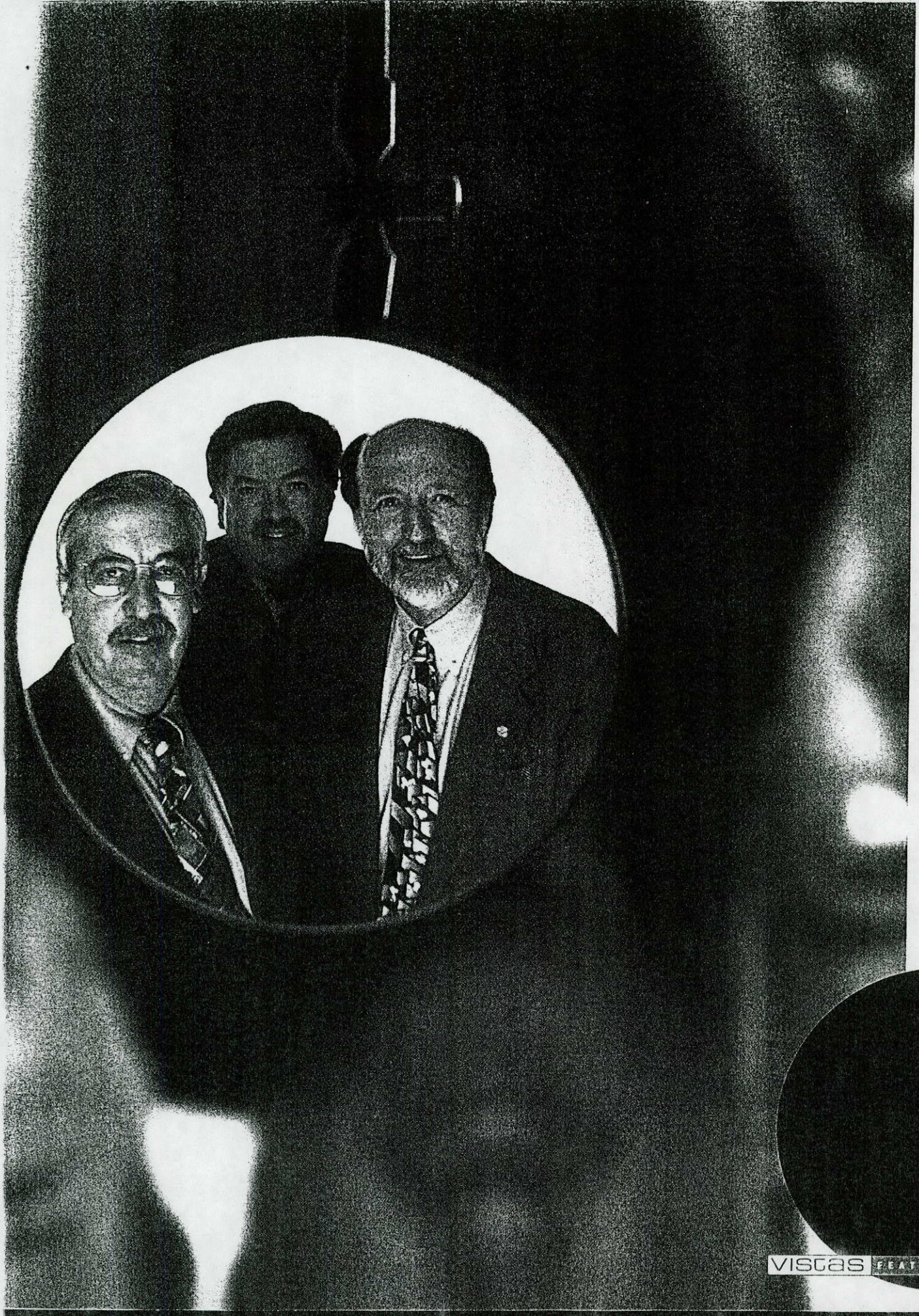
The catalytic reaction continues unimpeded, Spallholz said, because the elements used and created are present in all biological fluids.

The reaction is created when oxygen molecules collide with the selenium, which has a negative charge. During the collision, the oxygen molecules pick up electrons from the selenium, creating superoxide radicals, which then collide with something, typically bacteria, and oxidize, or kill, them. To keep the selenium stable and to keep the reaction going, a sulfur compound in the tear film gives an electron back to the selenium, starting the process again, Reid said.

"There's nothing to stop the reaction," Spallholz added. "That's why this permanent coating continues to be effective at stopping biofilm formation."

While the idea of putting a contact lens coated with a cell-killing chemical into the eye seems strange, the practice seems to be perfectly safe, Reid said, because the lens doesn't actually sit directly on the eye.

"The lens actually rests on the tear film on the surface of the eye," he said. "There is no direct contact with the cornea and even if there were, the half-life of the superoxide radicals created is less than 65 nanoseconds. There simply isn't enough time for the radicals to reach the eye."



In fact, Reid said, the distance the superoxide radicals can travel is barely half the distance of one bacterium.

"This is important because this is what prevents damage to the cornea," he said. "Even if these compounds could reach the cornea, there is no danger of damage because the top surface of the cornea is dying cells. The cornea resurfaces itself every three to four days anyway, minimizing the potential for damage."

The initial research on the selenium-coated lenses was funded by a $25,000 Vistakon Research Grant from the American Optometric Foundation. This original grant allowed the researchers to examine the effects of the selenium coating on lenses in both test tubes and in animal models using PureVision silicon-hydrogel lenses manufactured by Bausch & Lomb.

"Now we're waiting on approval for human trials," Reid said. "But, I'm ready to put them in my own eyes right now. We put the lenses in rabbits for two months solid and there was no evidence of damage to the cornea. We examined the corneal surface, the histology and thickness and there were no effects from the selenium. But, it's all conjecture at this point really. We need to get these into humans to see how they perform."

Human trials are important at this stage, Mathews said, because the animal trials didn't show any significant change in protein or lipid deposit build-up on the lenses, which would be necessary to dramatically increase the length of time the lenses can be worn without cleaning.

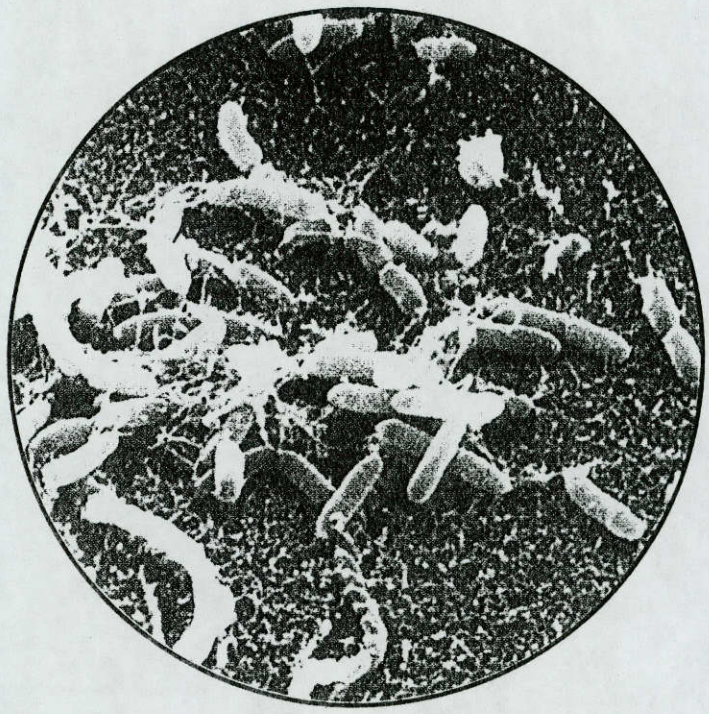
"It may be that rabbit tears are so different from human tears that they overwhelm the selenium," he said. "It's still possible that the selenium could have a favorable effect on deposition in humans. Protein deposits are still a major problem for contact lens wearers. That's why we've gone to disposables in the first place. Even the best cleaning can still leave up to 60 percent of deposits on the lens. It would be nice if the lens could actually reject deposits so you wouldn't have to throw them away. Ultimately, the best scenario would be to put these lenses on and not have to take them out for a year and to have them resist all the bacteria and deposits that currently cause problems."

While safety may actually be the main benefit of the selenium-coated lenses, the idea of wearing contacts for months at a time is what draws the attention of contact wearers. This prospect also has drawn media attention from across the world and the nation, Reid said.

The research, which was first presented at the annual meeting of the Association for Research in Vision and Ophthalmology in May 2002, also was presented recently at a meeting of the American Chemical Society, and has since been highlighted in newspapers in England, the Netherlands, Japan and Australia as well as across the United States.

Spallholz admitted that while creating a safer contact lens is the current focus, he sees bigger applications for this technology.

"You don't die because you can't see clearly," he said. "However,



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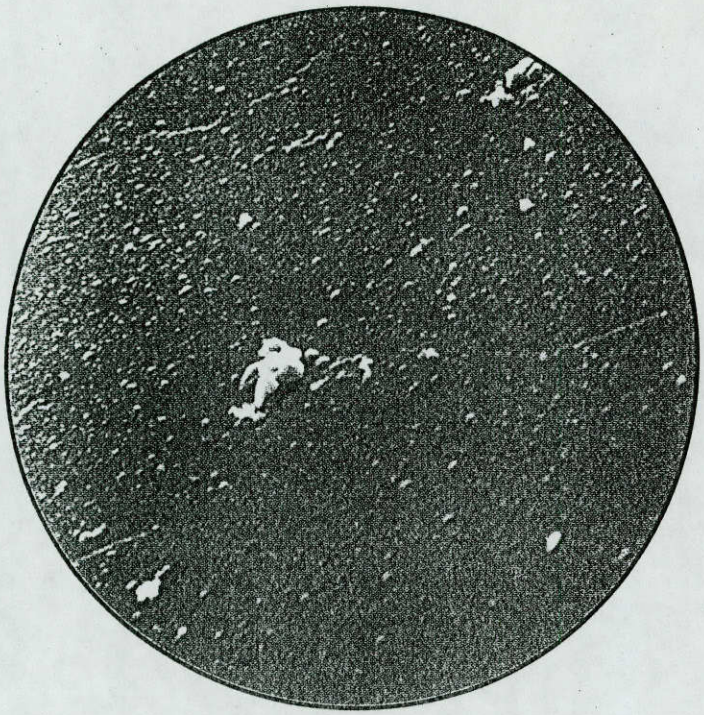


WITH SELENIUM: in the same conditions, contact lenses treated with selenium remain almost completely free of bacteria.

bacteria on things like heart valve replacements can be very dangerous. This may provide a way to prevent that. There are probably other applications that we haven't even thought of."

Reid said selenium coatings may be used to keep biofilms from forming on many other things that are surgically placed in the body, including glaucoma shunts, stents used to keep blood vessels open, ear tubes and catheters.

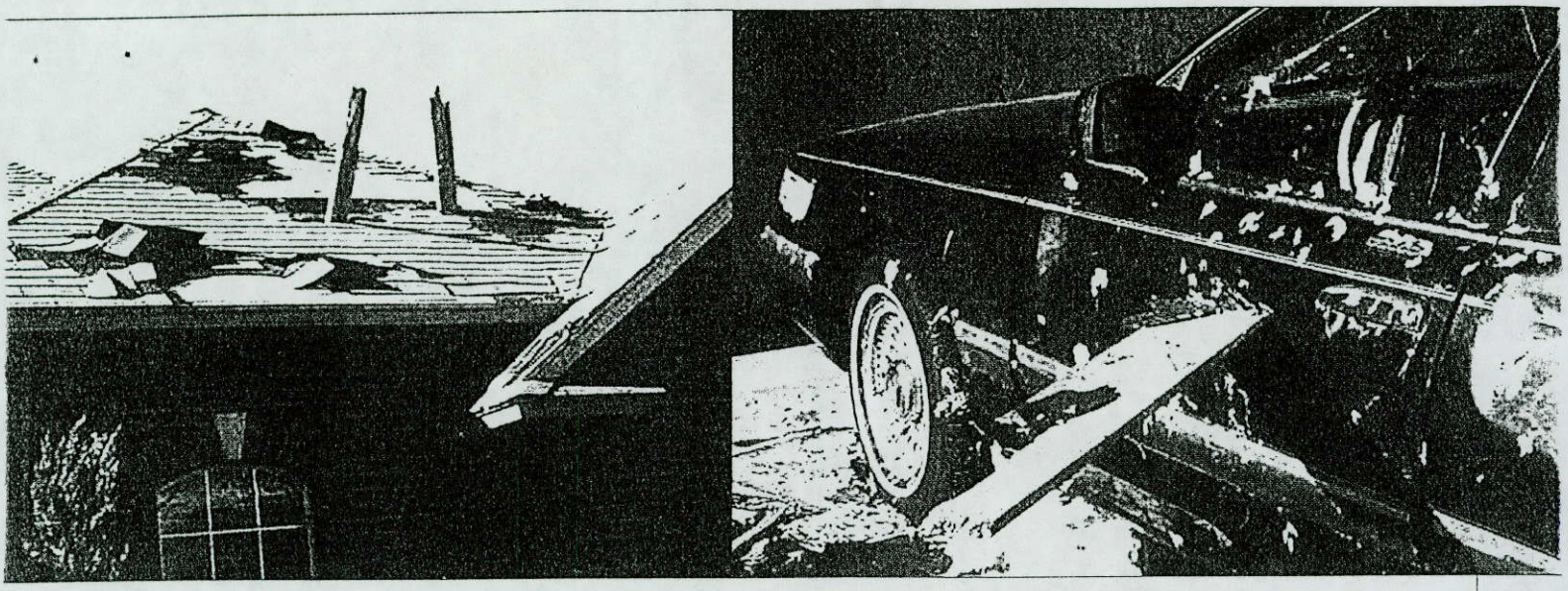
"This can be used on anything you don't want bacteria on in relation to the body," he said. "Bacteria are the single biggest problem with anything you put inside the body. When you surgically implant something within the body, you give high doses of antibiotics to fight infection, but in time, the bacteria will still find a way to this surface. This may give us a permanent way to treat that bacterial threat."

Spallholz said he believes selenium also may represent a breakthrough in the future of treating diseases by harnessing the chemical reaction produced within the body. He said researchers have done some interesting research using bacterial viruses to transport the selenium directly to the bacteria, creating a new treatment for numerous infections.

"This may present a whole new type of anti-bacterial drugs," he said. "This work with contact lenses proves that this can work. We can use what we've learned about selenium's ability to kill bacteria to treat drug-resistant strains of bacteria in the body. This is very promising, but it's going to take time, research and a lot of money." ←


DOWN FROM THE

by JOSH MURRAY // photo illustration by ARTIE LIMMER and T.J. TUCKER



TORNADO PHOTO ON OPENING SPREAD COURTESY: TEXAS NOAA PHOTO LIBRARY. NOAA CENTRAL LIBRARY: OAR/ERL/NATIONAL SEVERE STORMS LABORATORY

A TORNADO BLOWS THROUGH A SMALL TEXAS TOWN, DEBRIS FLYING INTO BUILDINGS AND CARS, WITH LIVES BEING THREATENED. ERNST KIESLING AND OTHER TEXAS TECH ENGINEERING RESEARCHERS ARE BATTLING THE FORCES OF THE WIND BY STUDYING THE EFFECTS OF MOTHER NATURE ON STRUCTURES AFTER THESE TERRIFYING STORMS.

Texas Tech University engineers began thinking about how to build an above-ground tornado shelter after a major storm devastated Lubbock in 1970. Now, 33 years later, some of those same engineers have not only developed that shelter but also have played an integral role in establishing national shelter building standards.

The shelter Texas Tech developed can be built as closets, bathrooms or they can be built in a garage. The concept drew major national media attention on NBC's Dateline after the May 27, 1997, tornado virtually wiped out a rural subdivision in the small central Texas town of Jarrell.

Ernst Kiesling, Ph.D., Texas Tech professor of civil engineering and director of the university's storm shelter program said that it was the 1999 tornado in Oklahoma City that drew attention to the need for standard building codes for above-ground storm shelters.

A shelter designed using plans similar to Texas Tech's plans survived the storm and is credited with saving the lives of two women. The Federal Emergency Management Agency began awarding grants for residents to build wind-resistant shelters, and the boom was on, but the lack of shelter standards and the dearth of experience in design and construction of shelters led to many quality issues.

Kiesling then invited a number of shelter manufacturers to Texas Tech to discuss the issues and plan a course of action. The National Storm Shelter Association grew out of that meeting. Shortly thereafter, Kiesling was appointed executive director.

"Our dilemma now is to encourage shelters to be built, but we want them to be of high quality, lest people are led to a false sense of security," Kiesling said. "We don't ever want to dictate that shelters are required, but if products are marketed as shelters, consumers need to know that they are getting quality products."

The International Code Council and the National Storm Shelter Association signed the first agreement on storm shelter building standards at the Federal Emergency Management Agency in Washington, D.C., in June 2002. Kiesling said the new joint standards consolidate existing references about shelter standards published by the National Storm Shelter Association, the Federal Emergency Management Agency and the American Red Cross into one standard to provide measurable and enforceable provisions for designing storm shelters. The new joint code will regulate the design, construction and installation of safe and economical shelters.

"The concept of the above-ground storm shelter grew out of research at Texas Tech," said Kiesling. Texas Tech's Wind Science and Engineering Research Center is internationally known for research aimed at mitigating the effects of extreme winds. One of the early successes was the development of an above-ground storm shelter that provides near absolute protection even in the strongest tornados. Texas Tech researchers have traveled to tornado and hurricane sites to evaluate damage and gain an

ABOVE: A STORM SHELTER THAT SURVIVED THE OKLAHOMA CITY TORNADO IN 1999.

> "Our research continues to find ways to economically provide protection from extreme winds and to reduce the damage they cause."

understanding of how to construct buildings and shelters to withstand winds.

As a result of their research, Texas Tech scientists and engineers have contributed to two Federal Emergency Management Agency publications, "Taking Shelter from the Storm," and "Design and Construction Guidelines for Community Shelters."

"The primary purpose of the National Storm Shelter Association is to foster quality in the shelter industry and to distinguish those products and producers that meet or exceed the high levels of quality represented by widely recognized standards," said Kiesling. "Our partnership in establishing a consensus standard represents a significant step toward achieving the goals of the National Storm Shelter Association."

Kiesling said these standards will evolve into a national consensus standard. Producers, engineers, architects and public members will be on a committee to closely scrutinize the standards and evolve into national consensus. After agreeing on the standards, they will be offered to building code jurisdictions for them to adopt into their codes. After that, it will become law for any shelter to meet the standard.

"We're elated with this step because it will be significant in the long run to improve the quality of shelters," he said.

Kiesling and Texas Tech wind engineers have now turned their attention to large-scale aboveground storm shelters suitable for schools and other public buildings. Past research had focused on small, single family shelters.

"A number of large, community shelters are now being built," said Kiesling. "In some instances, the entire population of a school, nursing home or business will be protected."

"For a tornado, people are inside the shelter for a relatively short time," Kiesling said. "But in a hurricane, people may need to spend hours in the shelter, so the shelter must have provisions for the occupants' physical needs."

"Our research continues to find ways to economically provide protection from extreme winds and to reduce the damage they cause," said Kiesling. ←

WEATHER DOMINATES

STORY BY SALLY LOGUE POST/JOSH MURRAY PHOTO BY ARTIE LIMMER

WEATHER DOMINATES TWO THINGS IN WEST TEXAS- conversation and the economy. Like no other factor, farmers in West Texas depend on Mother Nature for their livelihood. Farmers are always thirsty for the most up-to-the-minute weather information.

With Texas Tech University's West Texas MesoNet, wind, rainfall, soil temperature and other data are available every five minutes. In Texas, there are those who will tell you, that is just enough time for the weather to change.

Researchers in the Texas Tech Department of Atmospheric Science and Wind Science Engineering have designed a network of 35 surface weather stations and two atmospheric profilers in 28 South Plains' counties that covers an area of 150 by 200 miles surrounding Lubbock. The stations are located as far north as Friona and as far south as Lamesa. The most western station is located in Plains while the most eastern station is located in Roaring Springs. Each station is networked with the main server at Texas Tech's research station at Reese Center.

The towers stand 32 feet high and measure a variety of atmospheric conditions. "The MesoNet gives us data every 5 to 15 minutes, and the distance between sites is approximately 25 miles," said Tim Doggett, Ph.D., assistant professor of geosciences and head of the MesoNet project. "That's a vast improvement over the currently available data collected on a scale of 200 miles every hour."

The science of the MesoNet is nothing new. High quality weather observing technology are used to take measurements at standard heights, said Doggett. Humidity, wind, temperature, barometric pressure, rainfall, solar radiation, along with soil temperature and moisture, are collected at each station.

The information is sent to a central station at the Wind Science and Engineering location at Reese Center. The data are available to anyone free of charge on the Internet at www.mesonet.ttu.edu. The data also are archived so that users can see how conditions have changed over time.

The Texas Department of Economic Development has funded the project. The initial funding was used to purchase instruments and telecommunication equipment for the data sites and to hire personnel to manage the program.

The benefits of the MesoNet system are many. "A major component of the project is to provide the information to users in real time," said Doggett.

Farmers will gain from the increased soil temperature and moisture information. "With more data, farmers can better plan the planting and harvesting of their crops, leading to better crop yields," said Doggett. "The data also will help farmers know when is the optimal time to use pesticides and help them in determining their irrigation schedules."

For the National Weather Service, the MesoNet provides a better forecasting tool for severe weather. "The meteorologists can analyze current conditions at a resolution sufficient to forecast severe thunderstorm events," said Doggett. "This could ultimately save hundreds of lives and prevent thousands of injuries per year."

Power companies can use the data to plan power transmission and consumption needs of the region, he said.

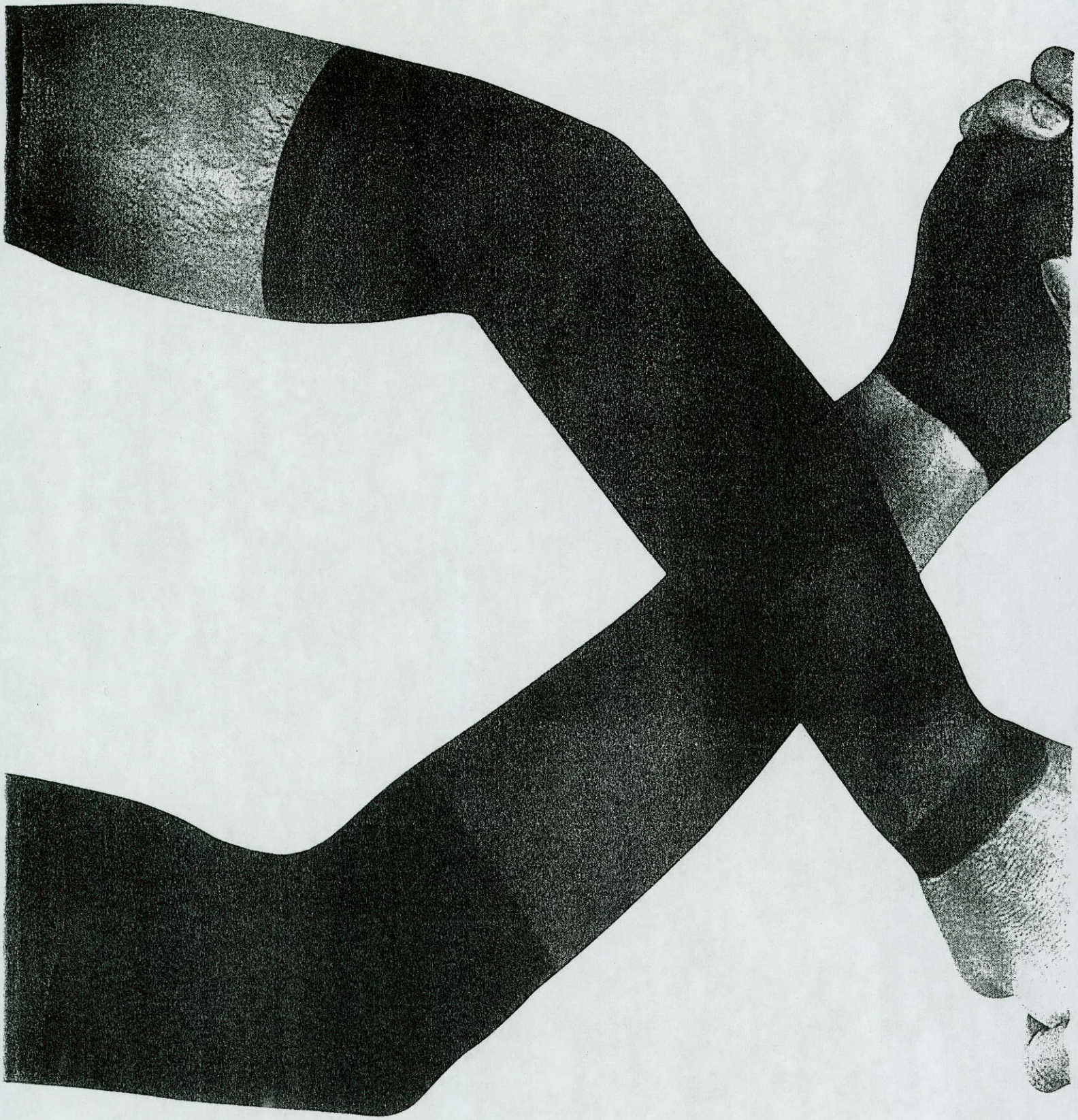
Educational uses for the MesoNet involve a partnership with Texas Tech Wind Science and Engineering Program, so that the MesoNet can provide research for a doctoral program.

"Schools and colleges across the state can also access the material to use in classroom projects and college-level meteorology programs," said Doggett.

Given the shear size of Texas, the cost of implementing such a system statewide has been prohibitive. Texas Tech scientists hope the West Texas MesoNet project demonstrates the feasibility of the network. Texas Tech and Texas A&M University are working together on a statewide venture.

Oklahoma, Colorado, Iowa and Georgia have MesoNet systems. "Data from Oklahoma suggests that Texas could save $100 million per year in the agriculture industry alone," said Doggett. ←

THE MESONET
gives researchers data on rainfall, wind, soil temperature and other data every five minutes.



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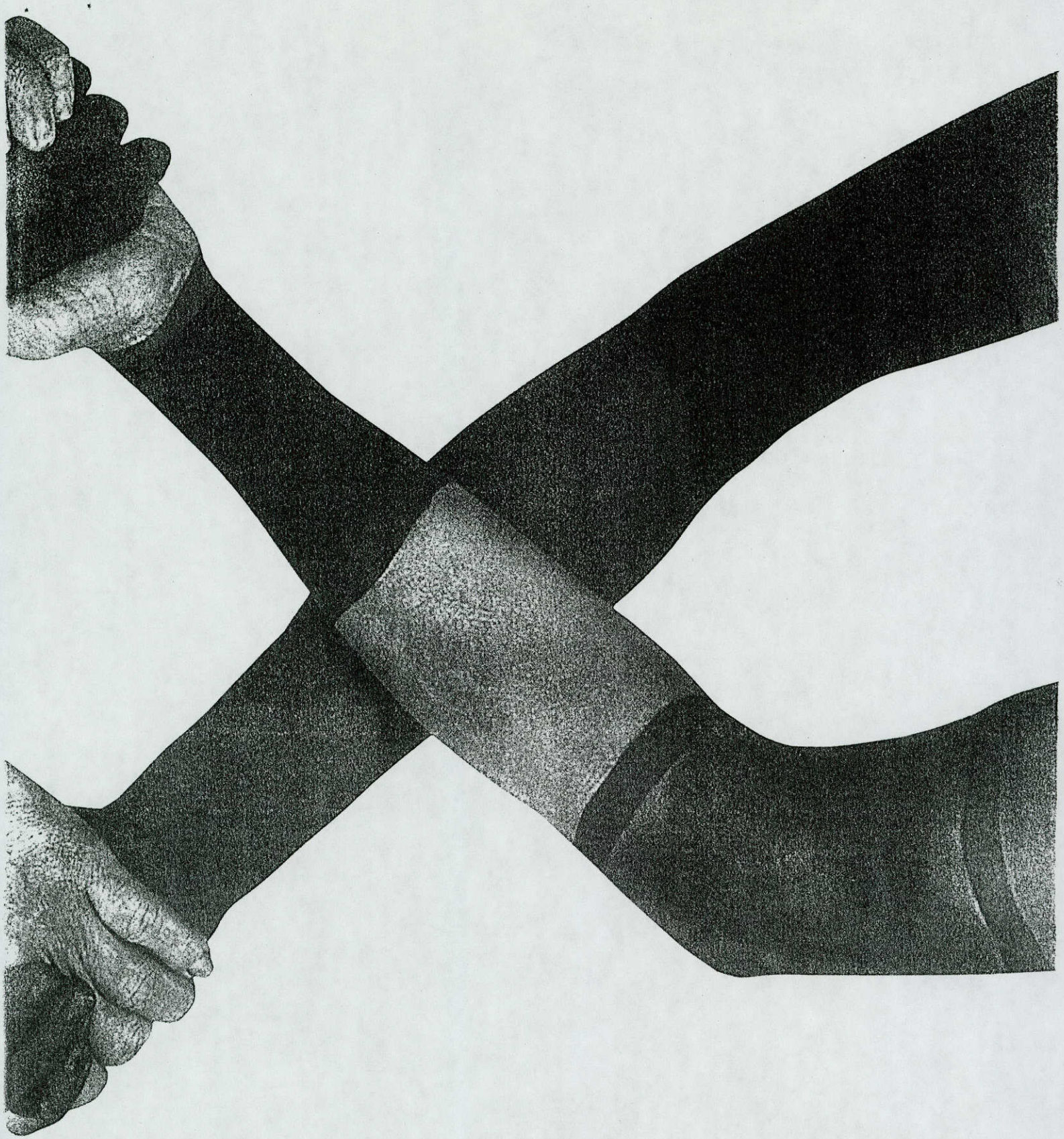


CHE

Molecular Pathology Master's Program Medical Director

DN

by Mary Hudspeth Peters
PHOTOS BY MELISSA GOODLETT

sometimes has been referred to as the s cr t code of life. Our DNA makes us what we are, determines what we look like, and influences what kind of diseases we might get.

A new master's degree program in molecular pathology in the School of Allied Health at Texas Tech University Health Sciences Center trains students to analyze DNA in the first master's-level program of its kind in the nation.

"Molecular pathology looks at DNA and RNA for mutations that might lead to serious diseases, like leukemia, cystic fibrosis and many types of cancer, that are caused by genetic mutations," said Barbara Border, Ph.D., associate professor in the School of Allied Health at Texas Tech University Health Sciences Center and medical director for the new master's program. Border said one aspect of molecular pathology is to diagnose a disorder in some cases before a patient has symptoms. "Certain preparations in the home can be made or plans for a hospital stay made if the disorder is diagnosed early," said Border, who is certified by the national credentialing agency as a clinical laboratory specialist in molecular biology.

Molecular pathology also can be used to diagnose a disorder while a fetus is still in the womb through prenatal screenings for genetic mutations, she said. "Many times we can test for recessive disorders. This means that two genes that are recessive, say for a disorder like cystic fibrosis, come together, such as from a mother and father to a baby, then that infant will have that disorder," she said "If someone were to think back about their relatives they might not know if their great-grandmother suffered from cystic fibrosis and wouldn't know they carried the disease in their genes. The diagnostic tools we have available today were not available then."

Another aspect of molecular pathology is the infectious disease component. "In the past decade, the way diseases like tuberculosis were diagnosed in the laboratory has changed dramatically," said Lori Rice-Spearman, M.S., associate professor in the School of Allied Health and program director for the molecular pathology program. "It used to be a very laborious 21-day process and now we've got that down to a 24-hour period."

According to Rice-Spearman, the best words to describe the field of molecular pathology are specific and sensitive. "We see a group of tests come into the diagnostic lab that are more specific and more sensitive, and we get incredibly rapid turnaround, which can affect treatment in the long term," she said.

She said many physicians, especially those who deal with infectious diseases, are going on their best guess until they confirm what they're treating. "They make an educated decision based on all the data they are able to collect before they have a confirmed diagnosis. And now, this type of testing will get that result much more rapidly," she said.

The first class of students for the program began their classes in May 2002. "We try to pull together students from very diverse backgrounds. Students who have degrees in areas such as the clinical laboratory science degree offered at the Health Sciences Center, bio-

chemistry, or biology are some examples," she said. "Our reasoning for getting students from these varied backgrounds is we see them filling different roles as diagnostic molecular scientists. We see them doing diagnostic clinical testing, going into industry, acting as consultants and actually being involved in the development of diagnostic kits."

Rice-Spearman said the overall goal and mission of the program is to train students to be clinical molecular scientists, give them very specific training in the techniques used in a molecular pathology setting and be able to apply the training in different areas.

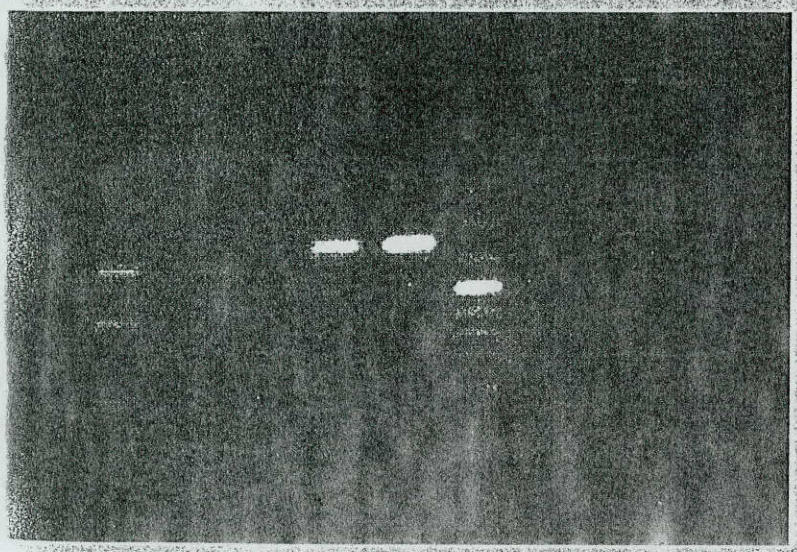
Border said the students in the program are involved in intensive training in which they will be in a laboratory alongside professionals and be trained in the various techniques in a clinical setting as part of their degree.

Border and Rice-Spearman agree that a typical molecular biology degree teaches basic science research but the molecular pathology degree provides more experience in a clinical setting.

"The third part of the students' education will be dedicated to a graduate-level research project," Rice-Spearman said. "This part will be more practice-based and may have assessment of clinical samples, management issues or ethical issues associated with molecular pathology." The school is currently setting up partnerships with laboratories across the state and nation where students can do their clinical training.

The laboratory facilities at the Health Sciences Center that the students use in their training include a "clean room" in which reagents are prepared, specimens are processed and DNA and RNA are isolated. The so-called "dirty room" contains special amplification equipment, DNA sequencers and an electrophoresis apparatus.

Spearman said these labs would be used not just for training scientists but also for providing a new level of testing for clinicians and patients in Lubbock and the surrounding area. Medical residents also will be involved with these labs to learn the aspects of molecular pathology.



WHEN NASA CHANGED ITS RESEARCH PRIORITIES FROM A FOCUS ON AERO AND ROCKET ENGINEERING TO ADVANCING RELEVANT AREAS OF COMPUTER SCIENCE, THE SPACE AGENCY TURNED TO DANIEL COOKE. NOW TEXAS TECH UNIVERSITY IS A KEY PLAYER IN A NATIONAL RESEARCH MISSION, AND AT THE HELM IS THE SPACE ACE. COOKE'S INVOLVEMENT WITH NASA BEGAN 10 YEARS AGO, WHEN HE WAS WORKING AT ANOTHER UNIVERSITY. NASA AWARDED HIM A SMALL RESEARCH GRANT TO WORK IN LANGUAGE DESIGN. BY 1997, HE RECEIVED A MUCH LARGER GRANT, AND AMONG OTHER TASKS, HE ENDED UP ASSISTING THE NASA AMES RESEARCH CENTER IN MOUNTAIN VIEW, CALIF.

STORY BY JOSH MURRAY >> PORTRAIT BY ARTIE LIMMER

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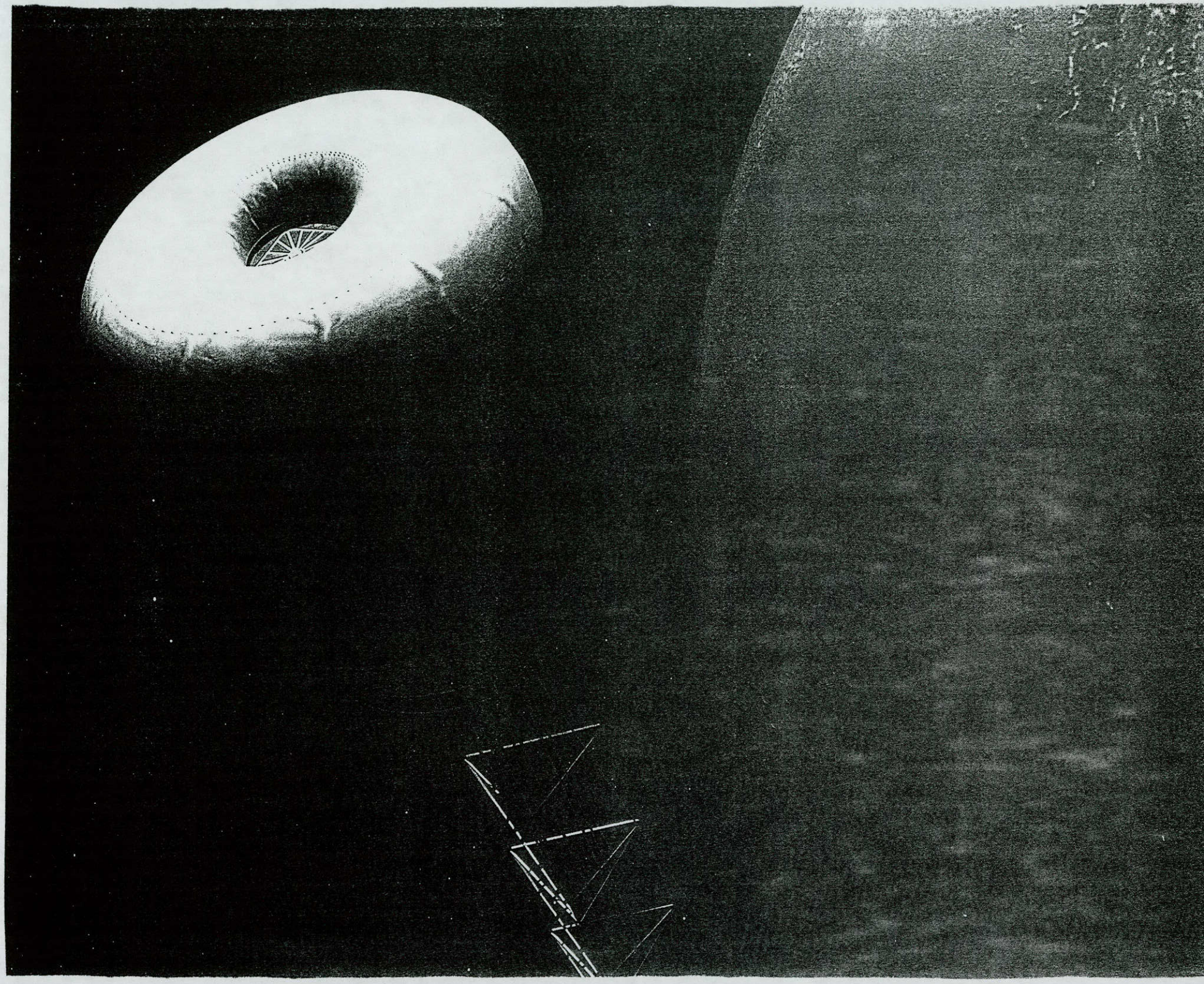
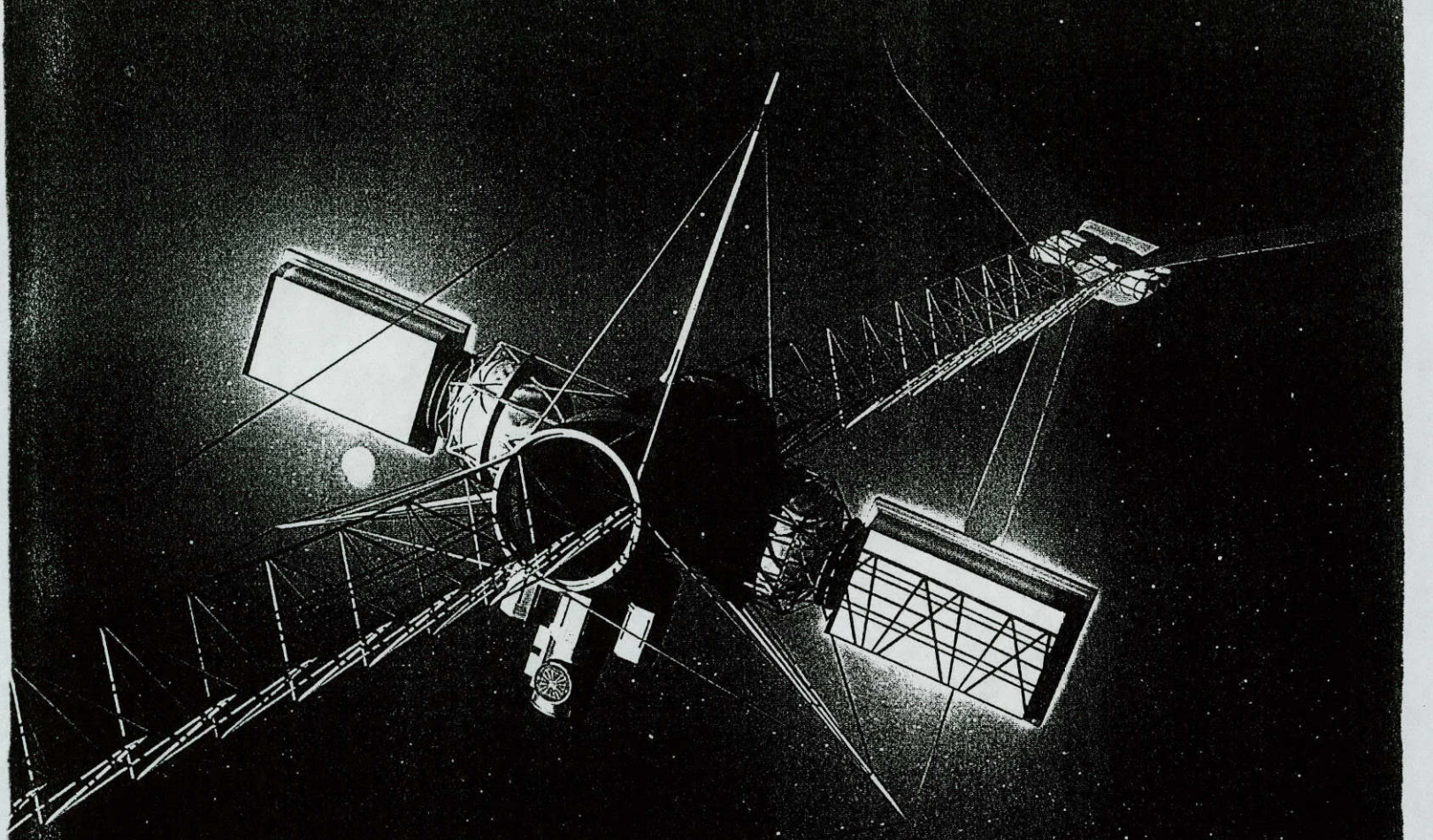
WINTER 2003 VOLUME 11 NO. 1





>>IMAGES BY JOHN FRASSANITO AND ASSOCIATES

About that time, a significant shift occurred in NASA's priorities away from aero and rocket engineering to computer science research.

In 1999, Cooke arrived at Texas Tech, and by December of that same year, Ken Ford, associate center director at Ames, was on campus asking to borrow Cooke to further NASA's efforts in computer science. Texas Tech agreed, Cooke accepted, and the rest is somewhat of a series of events that has made Texas Tech a key player in a national research mission.

Cooke, chairperson of the Department of Compter Science, was charged with launching a national initiative to advance computer science in the present century, much like NASA had advanced aero and rocket science in the last century.

With a five-year budget valued at $350 million, Cooke and his colleagues set out to develop the technical content of the Intelligent Systems Program. The four broad areas of research include automated reasoning to advance NASA's ability to conduct effective robotic missions. Another research area includes human-centered computing combining astronauts and robots. Additionally, the team set out to work in intelligent data understanding to find causal links in order to mine vast data stored from earth-observing satellites. And the final area was revolutionary computing which is focused on quantum and biologically-inspired approaches to computing.

"This is a significant effort for Ames. I had the good fortune to land in a program office as a leader of extremely capable individuals. They are very good at what they do, and they are really fine people. So in addition to establishing some important colleagues, I made a lot of really good friends," Cooke said.

Cooke said NASA officials reviewed the Intelligent Systems Program in a manner similar to the way in which the space shuttle or the space station programs were reviewed. He said the program achieved approval midway through his tenure as program manager.

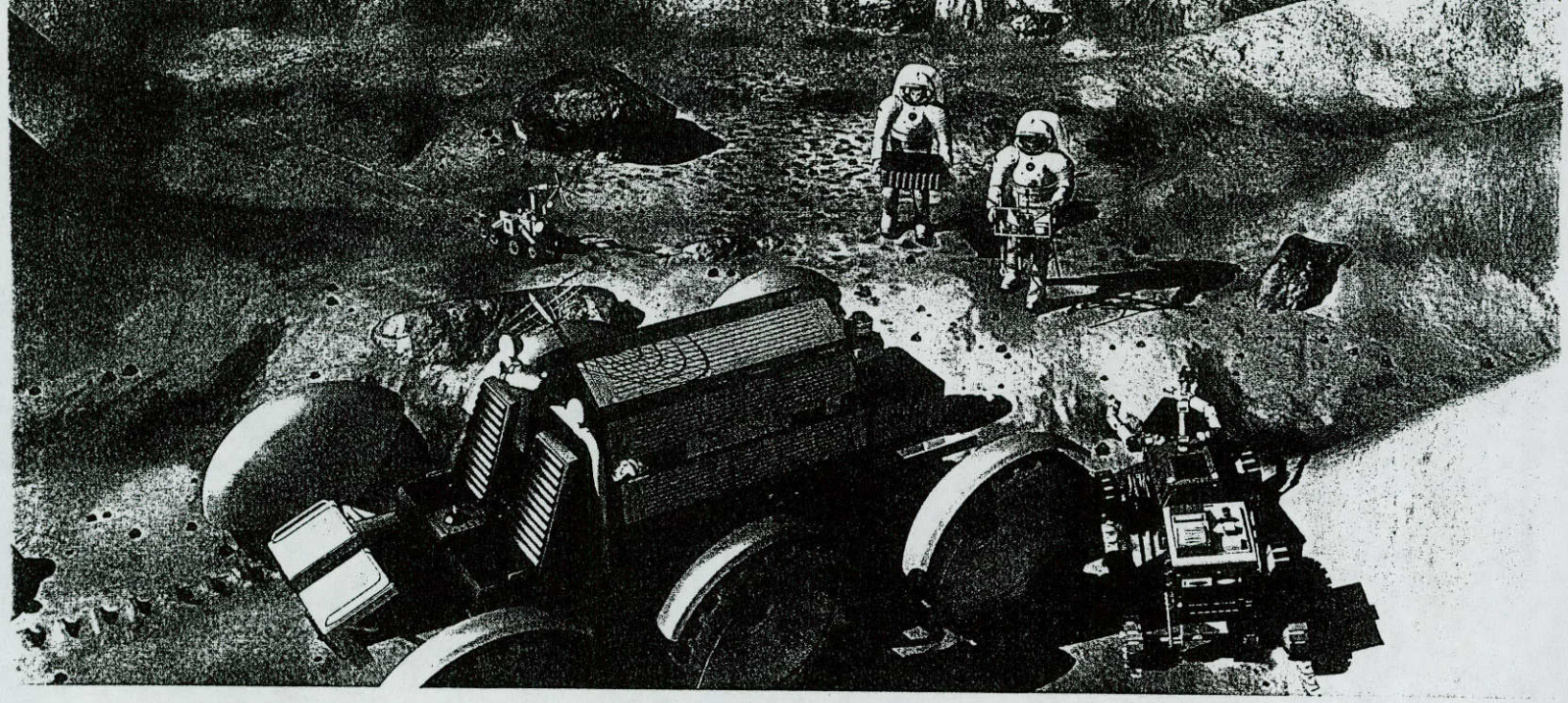
"Once approved the program initiated a major effort to solicit and review a large number of research proposals. From our initial call for proposals, we received over 500 proposals both from researchers in and outside NASA. Ultimately, we awarded 90 research projects around the country," he said. "The projects will help meet the milestones that NASA has set to achieve critical paths in certain robotic and human missions,"he said.

Cooke's final activity sent him to The White House's Office of Management and Budget. The program received high marks. The OMB review highlighted the Intelligent Systems Program as a model strategic initiative for NASA.

Cooke's work at NASA earned him the Exceptional Achievement Medal for his extraordinary service and dedication to NASA and to the Ames Research Center. NASA cited Cooke's untiring and creative energy as the first program manager of the Intelligent Systems Program.

Henry McDonald, Ames Research Center director, said Cooke managed the often difficult transition of the new program from formulation stage to the implementation stage.

"Dr. Cooke's vision, management skill, inter-



personal style and persistence enabled the Intelligent Systems Program to quickly establish itself as a model of strategic research for NASA. NASA's future missions in Earth and space sciences will benefit from the seeds sown by Dr. Cooke," McDonald said.

From there, Cooke has maintained a strong relationship with NASA. He maintains a dual role as a NASA adviser, and chairperson and professor in the Texas Tech Department of Computer Science, ensuring that students and faculty will be directly involved in space research.

Just one example, Cooke served on the Mars Study Team, a group of 18 people from around the country charged with coming up with new approaches to exploring Mars.

The team studied low-energy pathways in space, the so-called interplanetary superhighway that exists between libration points throughout the galaxy. "Ultimately, parking astronauts at a space station libration point near Mars seems to be the way to go. It's an extremely exciting way to go. There's a much lower risk and much lower cost according to the initial estimates when you compare it to existing mission plans that involve sending the astronauts directly from Earth to Mars. The station would serve as a springboard to result in the ultimate goal: to place humans on the surface of Mars," Cooke said.

Space-launch issues will always abound, he said, but the most stressing problems center on the need for the more autonomous spacecraft needed for long-distance exploration.

"We can't remote control long-distance missions. And right now, all human and robotic missions are remotely controlled. That's what mission control is doing, minute by minute," he said.

The problem is communication delays. At the speed of light, roundtrip communication to Mars ranges from six to 45 minutes. "So you want more autonomy. You have to pull the knowledge of mission control with you. That alone is a gigantic problem," he said.

Texas Tech scientists have had a theoretical breakthrough resulting in a prototype system able to identify correct workarounds in the event of a failure in some of the space shuttle subsystems. Workarounds represent a significant amount of the effort currently performed by mission controllers.

Michael Gelfond, Ph.D., professor of computer science, and Richard Watson, Ph.D., assistant professor of computer science, have developed a language, Answer Set Programming, which can find the workaround in a matter of minutes if there is a failure in a modeled subsystem. Cooke said the United Space Alliance, the company that operates the shuttle, is testing the language on shuttle subsystems.

Gelfond said artificial intelligence is a sub-field of computer science that allows people to determine what tasks can be automated by computers. In the beginning, people started with expert knowledge to play games such as chess or checkers, he said.

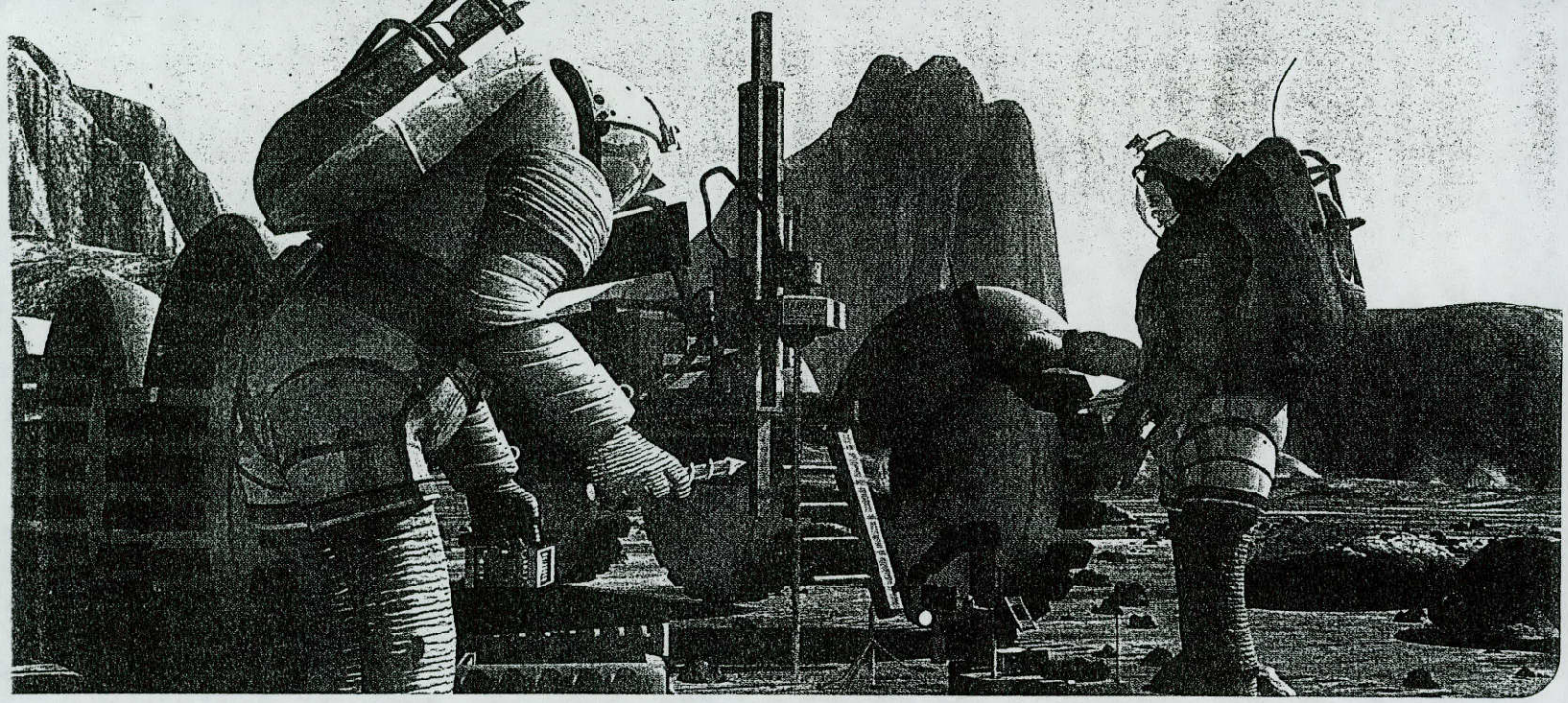
Gelfond first began to develop the theory in 1984. "It is much easier to teach a computer to play chess than how to perform or do everyday reasoning," Gelfond said. "When I started this theory, I had no idea it would have this application."

To develop the language, Cooke said it has taken literally decades of work that Gelfond has done in the area of common sense reasoning. "Trying to systematize and formalize common sense reasoning that humans do is a major undertaking. One of the interesting questions has to do with how far a machine's reasoning skills can be developed," he said.

He said Gelfond discovered the stable model semantic logic programming 14 years ago. "This model is accepted internationally. His paper on stable model semantics is in the top 10 cited papers in computer science literature," Cooke said.

Gelfond said people in Europe and the United States use his theory to build efficient reasoning systems, allowing computers to have reasoning skills. "There are two very efficient systems now, one in Finland and one in Austria, which implement the theory. We are now building one at Texas Tech."

"We've used our theories and languages to tell a computer as much about



the shuttle as it needs to know to find these plans. So you can imagine that the people on the ground have transferred the common sense knowledge they have to the computer," Gelfond said. "It's very tricky. It comes up with a sequence of actions needed to solve the problem."

Gelfond and the team have applied the answer set programming paradigm to developing a decision support system for shuttle control. Controllers on the ground can rely on computers to detect and solve system faults.

"Single faults almost never happen. It's almost always multiple faults. It means, for instance, that a collection of problems have created larger problems. The people on the ground know what needs to be done. Now they do it by hand under very stressful circumstances, and they don't have much time to do it. They want to automate it in so that the computer can solve the problem," said Gelfond.

Joining Cooke, Gelfond and Watson are William Oldham, Ph.D., professor of computer science, Hector Hernandez, Ph.D., associate professor of computer science, and Larry Pyeatt, Ph.D., assistant professor of computer science. And with excellence funding provided by the state, Texas Tech has established a Center for Advanced Intelligent Systems that, among other things, employs, Michael Helm, a top-notch programmer, as described by Cooke. "We're putting together a team to investigate a new form of control architecture to facilitate high dependability in future missions. NASA's current baseline involves the development of very complicated systems for advanced life support. We are focused on the creation of tools to design and implement these systems more effectively. Included in our effort are new approaches to find causal links in the data the systems acquire. Causal links leading to better data understanding are critical for automated learning and other advanced reasoning capabilities that will likely be required in future exploration systems," Cooke said, "Ultimately, what we'd like to do is look at control systems that involve more robotics."

In what he described as sounding like science fiction, Cooke said the researchers will look to see if humans can receive direct sensory input from robots, and whether a robot can receive the intent and will of a human from remote locations.

"We're talking about national challenges. We believe we can contribute to the national challenge. This is going to take a lot of researchers around the country a lot of time to solve these kinds of problems, but we believe we have some unique capabilities here to contribute to these solutions. And that's why these collaborations with the agencies are so important in order for us to be in tune to what is going on," Cooke said.

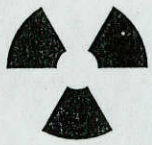
Researchers at Texas Tech's Center for Excellence in Abilene will be looking at dependability on another dimension. The team there will look at a form of tools and methodologies necessary to transition ideas from theoretical research into flight-ready systems for NASA. "One of the most important goals for a university is to produce knowledge. Having researchers engaged in significant research is very important for our students. We have a very good group here. It is fostering a good scientific learning climate. People who come to the university, either as a student or as a professor, come to learn," Gelfond said. "The culture of the university is determined by its learning climate. One of the signs of the climate is that world-class researchers are working together with graduate students or undergraduate students so that people from all levels can learn together. I teach some of this material in my classes, so it is something completely new."

Texas Tech's Center for Advanced Intelligent Systems will blend the talents of university computer scientists, industrial engineers, psychologists, physicists, biologists and mathematicians. "Our focus is fundamental computer science and its impact on dependability and humankind's ability to have a telepresence in future exploration missions," Cooke said. Success will be measured by the extent to which humans remotely exploring a region will have the same experience as that of a fully suited astronaut who is actually in the region. At that point, a significant number of areas can be effectively and remotely explored before the first human footprints are placed on a distant world. ←

EARTH

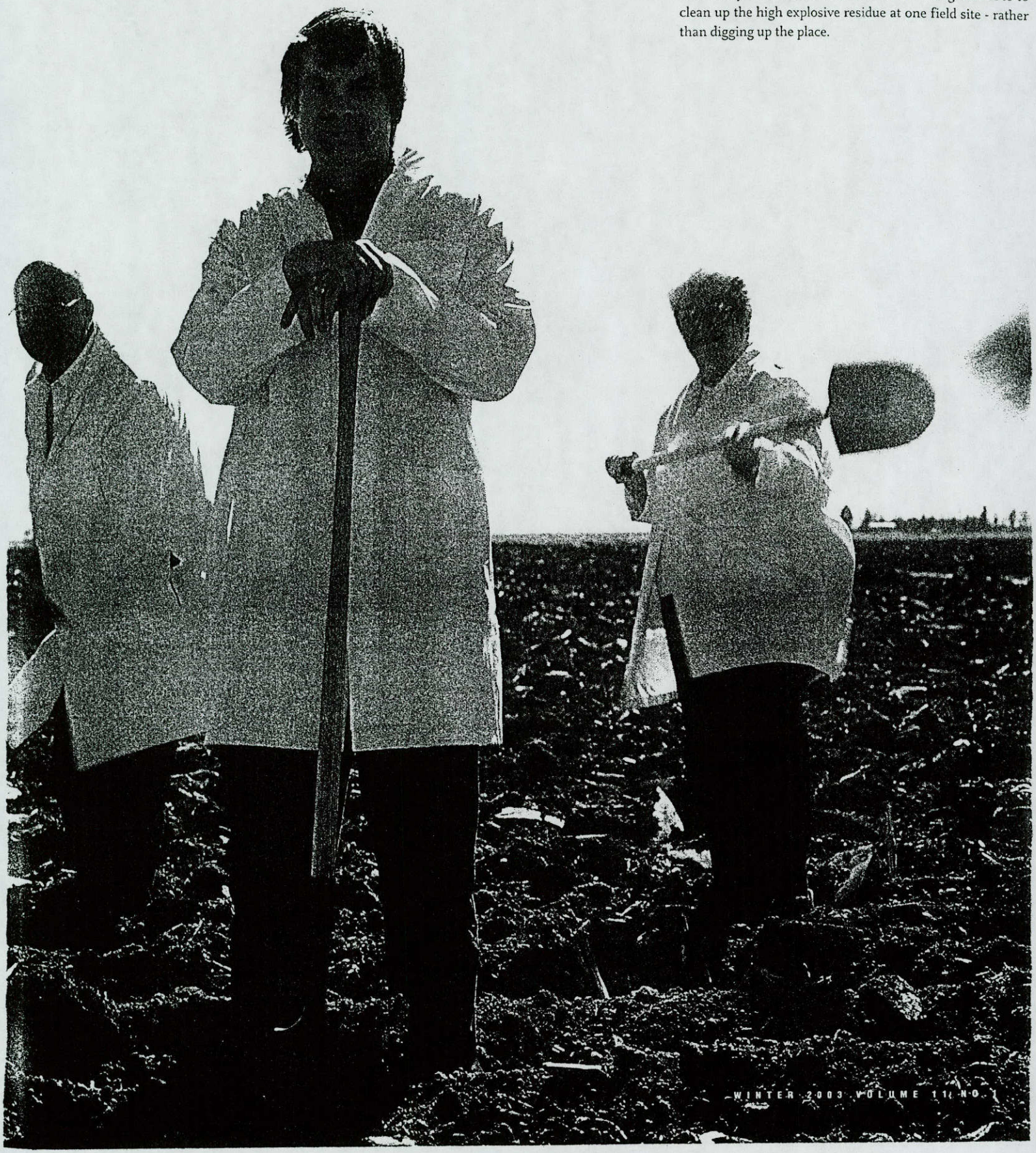
Fire & Ice

Rainwater



STORY BY Sally Logue Post : PHOTOS BY Artie Limmer

on conventional and nuclear weapons at the Pantex Plant, northeast of Amarillo, left behind contaminated soil and water perched above a major drinking water source. Researchers Ken Rainwater, Tony Mollhagen and Caryl Heintz, affiliated with the Texas Tech University Water Resources Center, are using microbes to clean up the high explosive residue at one field site - rather than digging up the place.



The PANTEX PLANT

produced conventional ordnance and weapons from 1942 until the end of World War II. In 1952, the Plant became the Department of Energy's final assembly and disassembly plant for all nuclear weapons. The work left the soil contaminated with high explosive residue that has seeped into water perched above the Ogallala Aquifer. The Ogallala Aquifer covers 174,000 miles from Texas to the Dakotas. The underground water is a major source of irrigation and drinking water for much of the Texas Panhandle-South Plains area.

"From 1952 until 1987, there was little or no environmental enforcement in these types of facilities," said Ken Rainwater, Ph.D., Texas Tech professor of civil engineering and Director of the Water Resources Center. "A lot of soil and water contamination has been found at weapon production facilities. Now the question is how best to clean it up."

Some Department of Energy facilities, such as Rocky Flats in Colorado, have closed. That, Rainwater says, makes cleaning up the soil easier. "At a closed base, you can knock down buildings and dig up the soil to get rid of the contaminants."

But the Pantex Plant is different in that it will most likely never close. Pantex is the only facility doing nuclear weapon disassembly, Rainwater said. Buried power lines and functioning buildings make it necessary for researchers to find a way to remove some of the contaminants without doing any major excavation.

Rainwater, who is one of the principal researchers on this project, says the good news is that the situation at Pantex has two advantages. When the facility was established in the 1940s, the government bought about 16,000 acres of land a good distance from the city of Amarillo, a situation that still exists today. Secondly, the groundwater contamination has not yet reached the part of the aquifer that is used for drinking water.

"Under the facility, there is a layer that's called the fine-grained zone within the Ogallala Formation," said Rainwater. "That layer has low enough permeability that water has ponded on top of it – and that's called the perched aquifer."

Rainwater said the high explosives his team has dealt with are RDX, HMX, TATB, TNT and TNB, the chief by-product of TNT. "We know what the facility has used, but because of the high-level security, we don't know how much of what they're mixing together or what compounds they put into which weapons," he said.

Rainwater says HMX has the least environmental risk associated with it, based on regulatory agency assessments. The amounts of HMX found in the soil fall within what have been established as safe levels by the Texas Commission on Environmental Quality.

When the Texas Tech researchers started their work in 1996, TNB levels in soil were above acceptable limits, but that's changed now. "Toxicologists and regulatory agencies have raised the standard by a factor of 600, which is higher than the levels we typically find in the soil," he said.

RDX is another matter. "We have found 10 to 20 times the amount of RDX that is considered safe," he said. "But the levels are not spatially consistent. In some spots we find very high concentrations of RDX. In others, we don't detect it at all."

RDX is now the main focus of the clean up, but Rainwater says even that could change. As with TNB, additional work by toxicologists could change the safety standard for RDX and that would mean the clean up effort could change or stop.

"Part of the problem with this effort is that people don't normally eat explosives and explosives are not used widely," said Rainwater. "We don't have a good handle on what contamination levels are safe to leave in the soil or in the water. The risk assessment people tend to be very conservative at first in setting allowable limits, and then they might go up later after new information becomes available."

The contamination comes from the way the explosives were handled during old assembly procedures. Workers shaped the plasticized explosives to fit into a weapon assembly. "They basically machined these explosives to fit into a certain space," said Rainwater. "It's similar to machining metal on a lathe. And if you've ever seen a lathe, there are cuttings or excess materials that are carried away by some type of liquid to get them out of the way of the cutting tools."

Most of those cuttings were collected with the liquids as a wastewater stream and sent through a filtration building for separation of the explosives. The filtered effluent still contained some explosives, and this flow was washed into concrete troughs that emptied into unlined ditches, he said.

A second source of contamination came from workers mixing the explosives with plasticizers in large kettles. When the kettles were cleaned at the end of the shifts, material that spilled from those kettles was later swept or washed out of the buildings onto the ground, said Rainwater.

"Both sources have contaminated the soil in a zone between the surface and the perched aquifer that is over 250 feet thick," he said.

Because Pantex continues to operate, buried utility lines make excavation unattractive in some locations, as does the cost to dig up that much soil. "So we had to find a way to remove the contamination in situ, or while

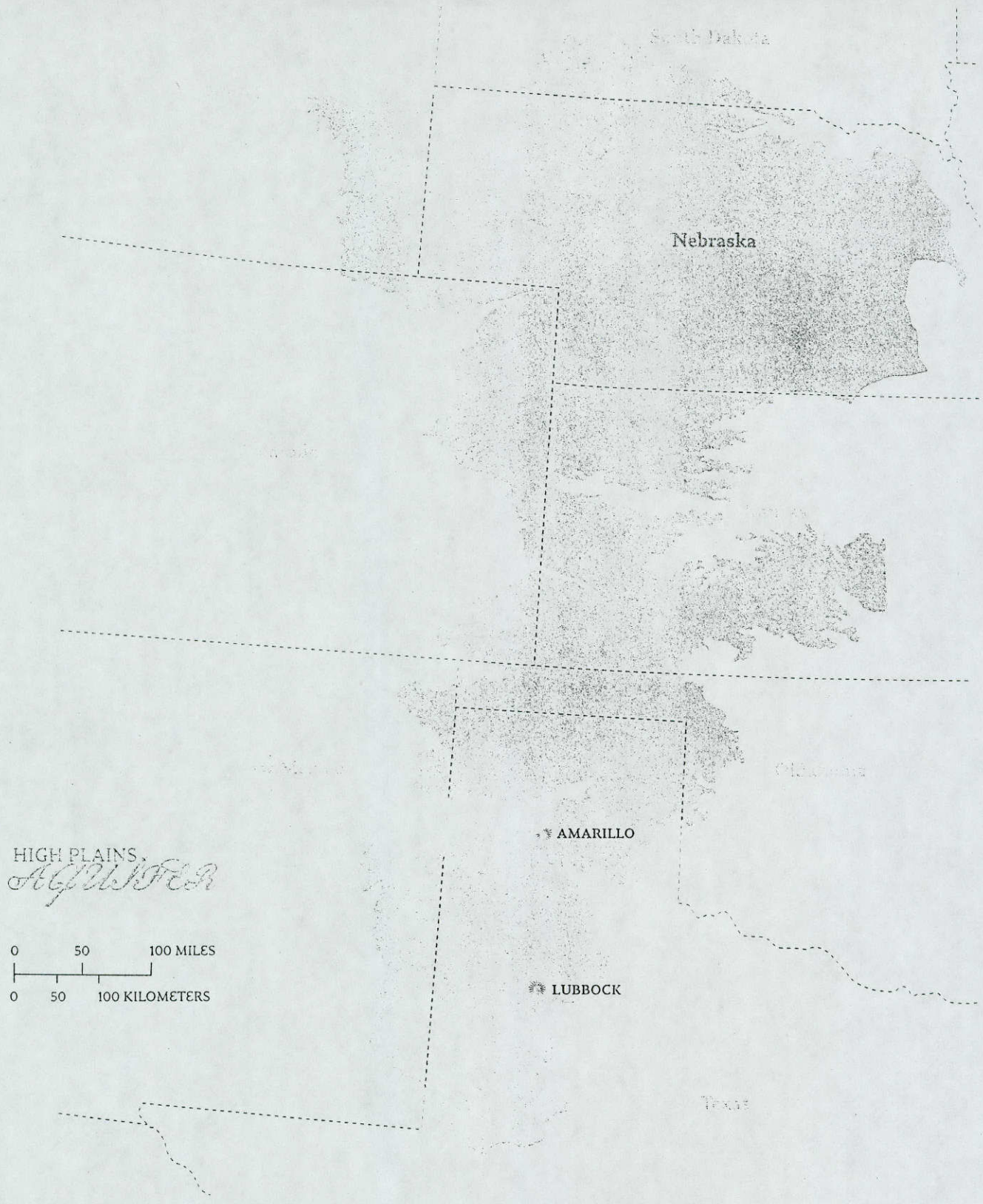
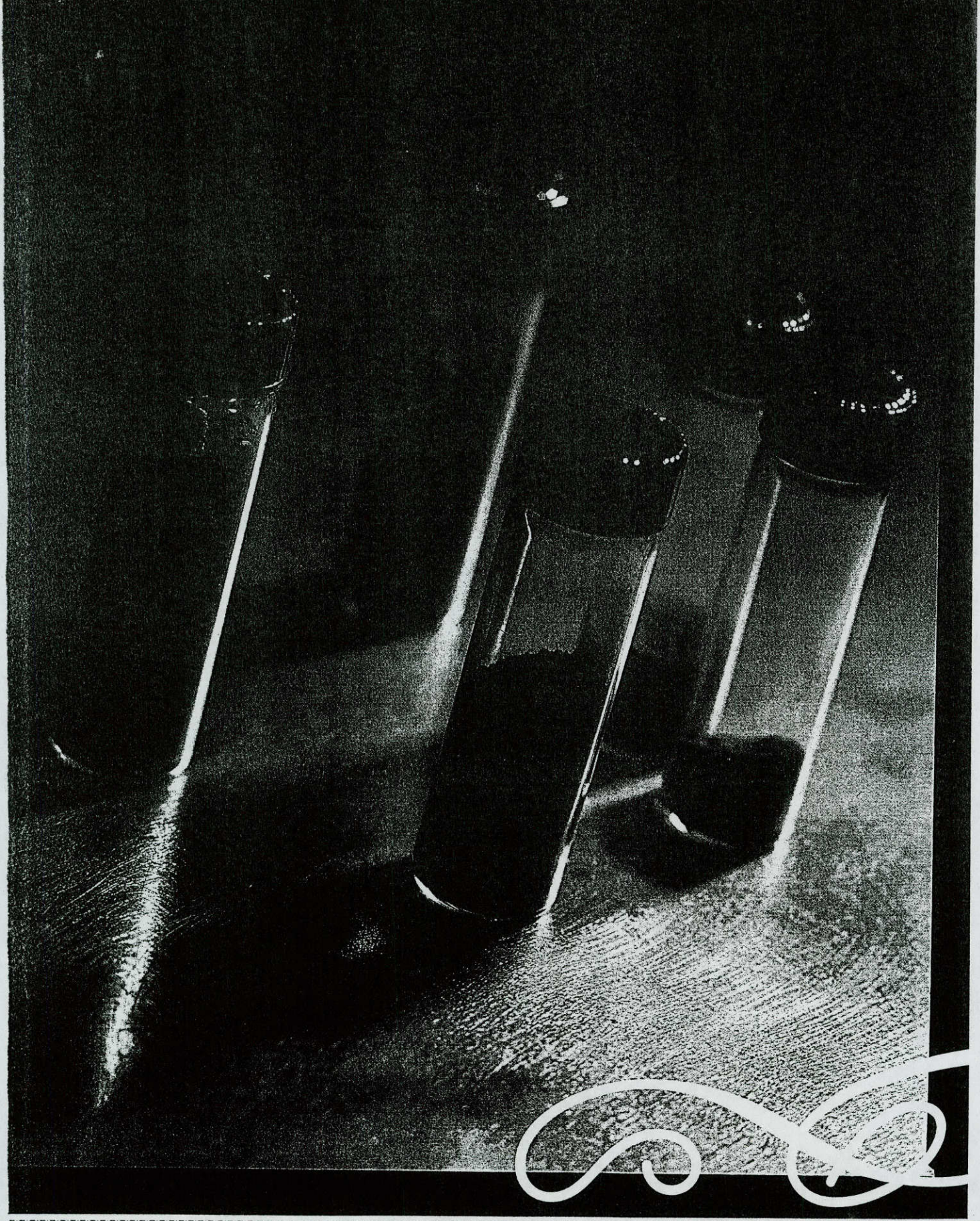


FIGURE 1. LOCATION OF THE HIGH PLAINS AQUIFER



leaving the soil in place," said Rainwater.

Enter Caryl Heintz, Ph.D., professor of biological sciences and associate academic dean in the Texas Tech College of Arts and Sciences. "We had the idea we could use microbes already in the soil to clean up the contamination," she said.

That idea came from a comment made to Heintz while she was a graduate student. "A professor told me that wherever a compound occurs in nature, there are microbes present that will metabolize it," she said. "Working from that assumption, we started to look at what microbes were present in the contaminated soil, and to determine experimentally if they could degrade the high explosive residue."

The science of how the microbes break down the high explosive reside is not complicated, said Tony Mollhagen, Ph.D., director of the Environmental Science Laboratory in the Texas Tech Department of Civil Engineering.

"If there is a chemical bond from which energy can be extracted, the microbes will find a way to do it," he said. "Microbes exist by finding new resources for food. They find a little niche that no other organism has filled. It's kind of like in business, if you find a niche no one else is serving, you can get rich."

So Mollhagen and Heintz set out to find the microbes that could "get rich" from eating high explosive residue. However, the microbes don't actually eat the high explosive residue. "The microbes secrete enzymes to break down and subsequently absorb the simpler compounds, much like the stomach does to break down food," said Mollhagen.

Two students who were working in Heintz's lab confirmed there were microorganisms in the soil that would break down the high explosives, especially if they had added nutrients.

In 1996, Pantex officials allowed Heintz and Mollhagen to collect soil samples from the contamination site. "We determined that the microbes that would do the job best worked more effectively if we could reduce the level of oxygen in the soil," said Heintz.

The science of bioremediation has been around for a long time. Wastewater treatment plants have used the process for years, and more recently microbes have been used to help clean up oil spills. However, Mollhagen says that taking specific microbes and enhancing them to work in specific, sometimes remote, areas is relatively new.

"There might be a lot more art to this part of science," he said. "In a laboratory, you can control all the environmental parameters, but you can't always do that in the field. You can't always assure the equal distribution of nutrients or water."

Once Heintz and Mollhagen knew there were organisms that would break down the explosive residue, the next question was how to make the microbes work more rapidly.

"We looked at a lot of possible nutrients," said Heintz. "About the only form that we could use 100 or more feet below the surface would be a gas of some sort. We settled on nitrogen because it would reduce the oxygen level, and that was what these particular microbes needed."

At this point Heintz, Mollhagen and Rainwater joined forces to begin planning to test their theories in the field at Pantex. The first steps were laboratory tests to determine whether nitrogen injection would lower the oxygen content enough to stimulate the microbes in the contaminated soil.

In 1998 the Texas Tech group was asked to meet with officials from the Department of Energy Innovative Technology Remediation Demonstration Program.

"There are several facilities that have similar soil contamination problems," said Rainwater. "The officials at the Innovative Technology Remediation Demonstration Program thought if more people worked together, we could share information."

One of the scientists Texas Tech researchers met during that collaboration was Corey Radtke with the Idaho National Engineering and Environmental Laboratory. Radtke, who is currently a doctoral student at Texas Tech, offered to perform the nitrogen experiments in his Idaho lab.

"He had more facilities and could do our experiments much more quickly than we could with less experienced graduate students in our labs," said Rainwater.

With positive results from those experiments, the Texas Tech researchers made the decision to do large-scale field-testing on site at Pantex. Soil samples were taken at the beginning and end of the test.

At the conclusion of that 300-day testing period, there were lower amounts of RDX and TNB in the soil, but Rainwater remained cautious about the results. "The average concentrations were lower," he said, "but you can't certifiably say that we made the decrease happen or that we just happened to sample in places where the RDX levels were lower to start with. The problem remains that the contamination levels aren't uniformly distributed. You can have very high levels in one place and none at all a foot away. Still, the folks at Pantex were encouraged enough to secure Department of Defense funding to build a much larger-scale testing area."

Besides continuing to examine whether nitrogen and other gasses will stimulate the microbial action, Rainwater says this second site will also help researchers get a real sense of operational costs to clean up a large area. An environmental consulting firm, Caldwell Engineering, lead by Tom Caldwell, a 1978 Texas Tech graduate, designed the site and directed its construction and initial operation.

The first samples from that area were taken on Sept. 10, 2001. The terrorist action of the next day shut down the experiment for several weeks. The tests were resumed and results from those are now being analyzed.

As for the Ogallala Aquifer, Rainwater says while there is contamination in the perched aquifer above it, there appears to be no pollution pathway to the drinking water. "So far there have been no consistent reports of contamination in the drinking water," he said.

Texas Tech's partnership with Pantex and the government continues, as does the work of disassembling the nation's nuclear weapons. While much tighter environmental standards have stopped the sources of new contamination, those microscopic "bugs" will hopefully continue to eat their fill of high explosives and help solve a major environmental issue. ←

THE TEXAS TECH RESEARCHERS WISH TO ACKNOWLEDGE SEVERAL PEOPLE WHO HAVE CONTRIBUTED TO THIS COOPERATIVE EFFORT. SEVERAL ENVIRONMENTAL PROFESSIONALS IN THE PANTEX ENVIRONMENTAL RESTORATION GROUP HAVE FACILITATED ACCESS TO THE SITE, SOIL SAMPLING, AND FINANCIAL SUPPORT, INCLUDING JAY CHILDRESS, TONY BIGGS, MARLIN CONNER, MARTIN AMOS, CRYSTAL MITCHELL, JANICE CLARK, AND DENISE DURHAM. FIELD REPRESENTATIVES OF THE S.M. STOLLER CORPORATION GRACIOUSLY PROVIDED THE ORIGINAL SOIL SAMPLES. SEVERAL GRADUATE RESEARCH ASSISTANTS PARTICIPATED IN THE LABORATORY AND FIELD WORK, INCLUDING WALT MEDLOCK, SAJJAD SHAHEED, RUURD PEPPEL, JUSTIN BROWN, DOUG DURANT, CHRIS PHARR, GREG CRABTREE, AND MELISSA KELM. BRAD THORNHILL, MANAGER OF THE ENVIRONMENTAL SCIENCE LABORATORY, HAS BEEN INVALUABLE IN ALL ASPECTS OF THE FIELD INSTALLATION AND OPERATION, AS WELL AS OVERSEEING THE LABORATORY ANALYSES.

GARY ELBOW PH.D.
JANE BELL

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Angela Boston

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IMMERSION

Imagine living in a village that had no electricity or indoor plumbing. With no access to a laptop computer, you have only a kerosene lantern as the only source of light during the evening hours. For some people, this Robinson Crusoe-like way of life would be unbearable compared to the comforts and luxuries found in a developed nation. For Phil Dennis, Ph.D., a professor of anthropology in the Department of Sociology, Anthropology and Social Work, living in a village, such as this one in Nicaragua, presented an opportunity to learn more about the culture of local Miskitu people while teaching as a professor at a local university in a nearby city.

For 11 months, Dennis taught a medical anthropology course at the University of the Autonomous Regions of the Caribbean Coast in Puerto Cabezas, Nicaragua. While teaching at the university, Dennis said he lived with Miskitu speaking villagers in Awastara, a village 40 miles north of Puerto Cabezas on the Atlantic Coast. In his spare time, he worked alongside villagers in fields, attended church services, and helped catch green sea turtles at sea. His interactions with his Miskitu friends became part of his research that was documented in a book manuscript he recently completed. Dennis said he cherishes the experiences he gained from living on the east coast of Nicaragua as a U.S. Fulbright Scholar.

"The Fulbright Scholars Program has been tremendous from the beginning," Dennis said. "For me, having a Fulbright Fellowship is a chance to do what an anthropologist does, which is to live with people and immerse yourself in their culture."

For more than 55 years, the U.S. Fulbright Program has given numerous students, educators and professionals the opportunity to expand on their intended areas of study to conduct advanced research. Professors have the chance to serve as visiting faculty members at a university in a foreign nation under the

FULBRIGHT SCHOLARS

Fulbright Scholar Program. The Fulbright Student Program is available for U.S. students who are graduating seniors or graduate students. International scholars and students travel to America under the Visiting Fulbright Scholar Program. Each Fulbright recipient has a unique experience while participating in the program.

Each year, 800 scholars and professionals travel internationally to participate in this academic exchange program. During the 2002-2003 academic year, two alumni and one professor at Texas Tech University have been selected to be a part of the U.S. Fulbright Scholars Program. The student

and professional scholars will be involved in facilitating various research projects while experiencing the beauty and essence of another culture.

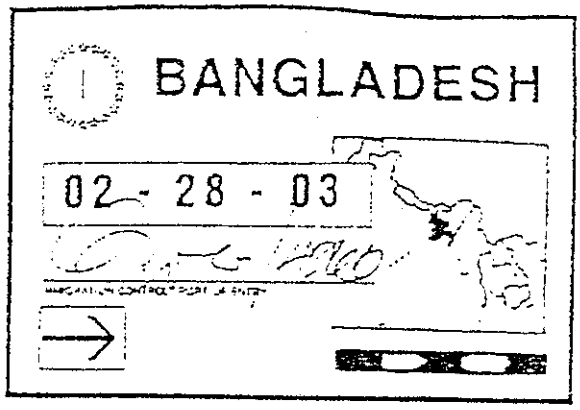
For nine months, Jan Kamler, Ph.D., a May 2002 doctoral graduate of Texas Tech, will study abroad in Eastern Poland as a Fulbright Student Fellowship recipient. The former doctoral wildlife science student from Kansas City, Kans., will study the red deer population. During his study, Kamler said he will examine the impact of wolf predation on red deer while he works at the Mammal Research Institute in Bialowieza, Poland. While working at the institute, Kamler will conduct his research alongside other ecologists.

From his research, Kamler said he hopes to determine whether wolves are controlling red deer populations by preying on them. Kamler said Polish researchers began to examine how the population of red deer affected the conditions of their forests. According to Kamler, a vast number of red deer have overgrazed forests throughout Europe causing deforestation. He said he decided to observe the effects of wolf predation on Polish red deer because of his graduate work on the interactions of predators and prey in natural ecosystems.

"I think the most significant importance of becoming a Fulbright Scholar is that you get exposed to science, or whatever field you are interested in, while visiting another country," he said. "It broadens your perspective in your field. It will be a valuable experience for me."

Kamler said his Fulbright Fellowship allows him the opportunity to travel to Poland for the first time. While in Bialowieza, Kamler said he looks forward to gaining insight into Polish culture.

Viswanath Subbaraman, a May 2002 Texas Tech graduate with a master's of music performance and a native of Big Spring, Texas, will delve into the world of music as a part of his Fulbright Student Fellowship. For eight months, Subbaraman will conduct research into orchestral conducting while working as an assistant with the Ensemble Orchestral de Paris in Paris. During his study, Subbaraman also will visit area libraries to look at manuscripts of orchestral music composed by French composers Hector Berlioz and Claude Debussy. As a part of his research, Subbaraman said he also will observe and study under the orchestra's conductor, John Nelson. Through his research efforts, he said he hopes to grasp the interpretational challenges faced when performing classic and contemporary French orchestral music.



Subbaraman said he chose to conduct his study in Paris because of the city's rich history in classical music. He said the city is an ideal location to examine the origins of French orchestral music because this genre of music began there. By visiting Paris, Subbaraman said he will gain an understanding of the direction of the French classical repertoire

today. Prior to his Fulbright Fellowship, Subbaraman studied in Aubagne, France, for several weeks in 2001.

"My visit to Paris will be an exciting opportunity for me to be exposed to great music," Subbaraman said. "I think it is a great opportunity to study where the music originates."

Prior to receiving a Fulbright Student Scholarship, Subbaraman said he had studied overseas. During his undergraduate studies, he went to Vienna, Austria, for a semester. By visiting Vienna, Subbaraman said he gained a different perspective on music and became more open-minded to issues affecting other cultures.

"The Fulbright Program gives people an opportunity to explore other cultures and bring their knowledge of that culture back as they return to the United States," Subbaraman said. "To me, everyone should be required to go to another country to study."

In the spring of 2003, John Barkdull, Ph.D., an associate professor of international politics in the Department of Political Science, will trek overseas to complete a Fulbright Scholar Fellowship. Barkdull said he received a grant from the program to teach at the Dhaka University in Bangladesh. For six months, Barkdull said he will teach classes on globalization and civil society. During his fellowship, Barkdull said he not only wants to teach, but he also wants to learn more about Bangladesh's perspective on globalization and civil society organizations in an effort to expand on his research in regard to these two areas within political science.

Idris Traylor, Ph.D., can identify well with the Fulbright Scholar experience. While attending graduate school, Traylor, the executive director of the Office of International Affairs, completed a Fulbright Fellowship. For one year, Traylor, who is also the director of the International Cultural Center, attended the University of Vienna in Austria. As a visiting student, Traylor said he studied Eastern European and Russian history and minored in international arbitration law. During his studies at the university, Traylor said he worked on his doctoral dissertation.

"For me, having that experience as a Fulbright Scholar was life changing," Traylor said. "I was able to experience the richness of the Austrian culture."

Today, Traylor works closely with the Fulbright Program at Texas Tech. In his position, Traylor said he appointed Jane Bell, director of special projects in the Office of International Affairs, as the Fulbright Program adviser. Traylor said Bell assists Fulbright applicants with their applications and reviews their proposals and essays.

By participating in the Fulbright Scholars Program, Traylor said faculty members are able to take what they have learned from their fellowship and incorporate that knowledge into the classroom.

"In every case, the program allows for faculty members to expand their international experience, enhance their own research and also maintain or improve their language ability in a foreign country," Traylor said. "Ultimately, what faculty members have learned as Fulbright Scholars is reflected in their publications and classroom performance."

By becoming a Fulbright Scholar, Gary Elbow, Ph.D., chair of the Fulbright Campus Committee for undergraduate and graduate students, said students who are Fulbright recipients have the opportunity to explore another culture in an attempt to gain a different perspective on the world. Elbow, who is also a professor in the Department of Economics and Geography, said seven Texas Tech students have participated in the international exchange program over the last four years. Previous recipients of the student Fulbright Scholarships have traveled to Germany, Vietnam, Peru and Canada.

"The Fulbright Program gives American students the opportunity to learn about other countries and have direct relationships with people from all over

the world," Elbow said. "When students return to the United States, they can use the knowledge they have gained while studying in another country."

Since 1998, 11 faculty members at Texas Tech have continued their research while residing in another country. Faculty members have ventured across borders and overseas to locations such as France, Iceland, Germany, Zimbabwe, Paraguay and Mexico.

"With faculty and students alike participating in the Fulbright Program, Texas Tech is being recognized as having outstanding professors and students who can make a contribution, and that reflects great honor on the individual scholars and our university," Traylor said.

Bell said students who choose to apply for a Fulbright Fellowship must have a compelling need to study internationally and they must write a strong proposal. Bell said both Kamler and Subbaraman were excellent candidates for the Fulbright Program because of their thorough research and the well-written proposals, which they submitted to the Texas Tech University Fulbright Campus Committee.

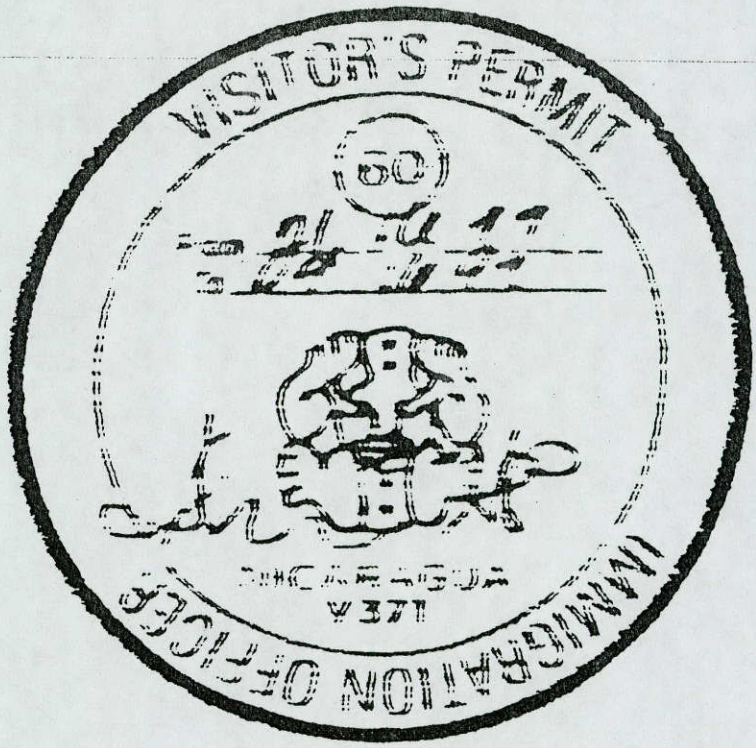
"What is a great about the Fulbright Program is that it is one of the finest opportunities that really industrious students have to further their research and study for an academic year in a foreign country," Bell said.

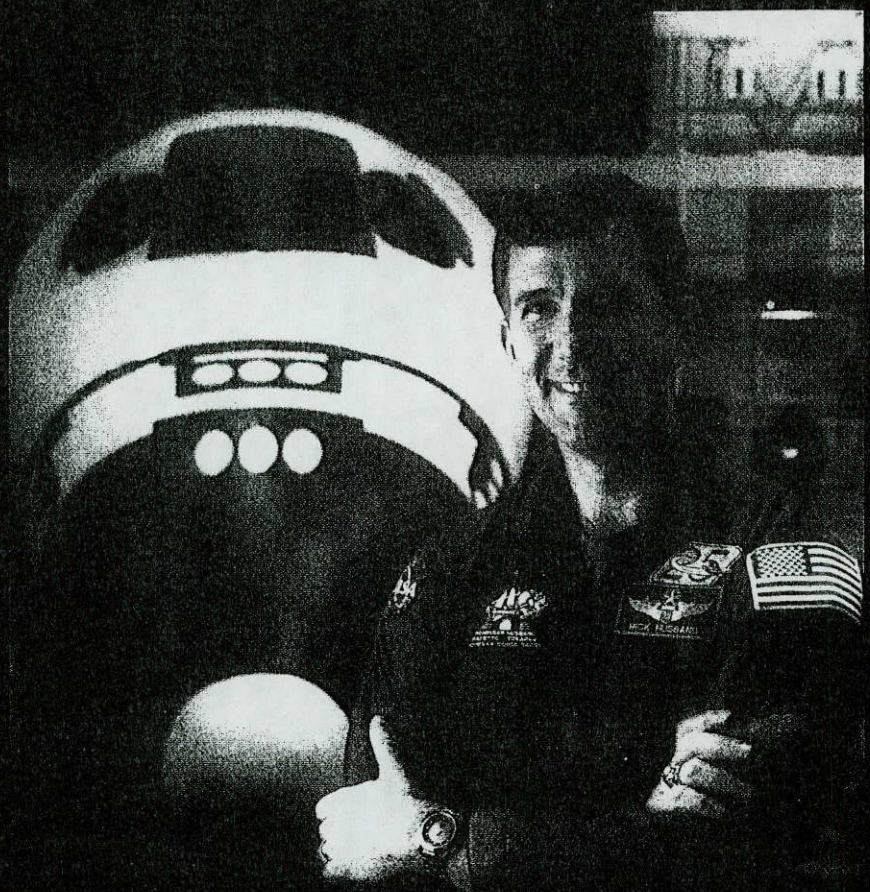
To become a strong candidate for the Fulbright Scholar or Student Program, Bell said applicants need to propose interesting research projects that can be completed within an academic year. Throughout the process of applying for the program, Bell said students should consult with their professors in their area of study so that they can receive assistance in fine-tuning their written proposals. She said seeking help from a professor can help students make contacts with professors at the universities where they want to conduct research. Once they have made contacts with professors in the country where they intend to do their studies, students are able to demonstrate to a selecting committee their level of commitment to a Fulbright Student Fellowship, she said.

"The program is a great boon to our university because of the prestige of the scholarship," Bell said. "It reflects quite well on the university."

Bell said she advises applicants to begin the process for applying for a Fulbright Fellowship early. She said campus interviews are typically held in early October.

At its inception, the Fulbright Program made it possible for American students, educators and professionals to connect to the rest of the world. Today, the program continues to bridge relationships and form cultural understandings between U.S. citizens and people from other nations. The Fulbright experience has given people the opportunity not only to enhance their research, but to immerse themselves into another culture. ←





RICK HUSBAND / CLASS OF 1980

Will the deep, blue skies of Texas ever be looked upon again without our remembering the white streak of destruction as the Space Shuttle Columbia came crashing down to Earth on Feb. 1, killing the seven searching souls who reached for the stars and planets as NASA's brave astronauts? The pain of the loss of such precious lives probably will never leave us, just as their legacies and sacrifices will never be forgotten. Those lost – Commander Rick Husband, pilot William McCool, the first Israeli astronaut Ilan Ramon, payload commander Mike Anderson and mission specialists Kalpana Chawla, David Brown and Laurel Clark – soared into space as the crew of STS-107 for 16 days and came so close to coming home before perishing 200,000 feet above Earth during entry, 16 minutes before their scheduled landing.

The deaths of Husband and McCool hit Lubbock and Texas Tech University especially hard as the two astronauts had historical ties to the South Plains. Husband was a graduate of Amarillo High School and earned a bachelor of science degree in mechanical engineering in 1980 from Texas Tech. He was a member of the Texas Tech Alumni Association and was named a 1997 Distinguished Alumni of the College of Engineering. McCool was a 1979 graduate of Coronado High School in Lubbock, and his mother, Audrey McCool, taught from 1977 to 1981 in the Department of Food and Nutrition in the College of Human Sciences at Texas Tech. These explorers and their five companions were heroes of international proportion.

"A hero is someone who has given his or her life to something bigger than oneself," proclaimed the late mythologist, American philosopher and author Joseph Campbell. In pushing the bounds of space and science, the Columbia astronauts were contributing to all of humanity. Campbell also said, "When you see the Earth from space, you don't see any divisions of nation-states there. This may be the symbol of the new mythology to come; this is the country we will celebrate, and these are the people we are one with." These seven individuals portrayed intelligence, creativity and risk-taking to find out what is out there in the great beyond, to do what is inconceivable for most of us. Astronauts are possibly the best examples we have of heroes in the Joseph Campbell sense, ferrying out beyond human knowledge to find out where it all started. Like many of the great mountaineers who dressed up their climbing expeditions in scientific trappings, the doing – the chance to measure ourselves against the unknown – is important in itself. The world always will remain grateful to such pioneers of the universe.

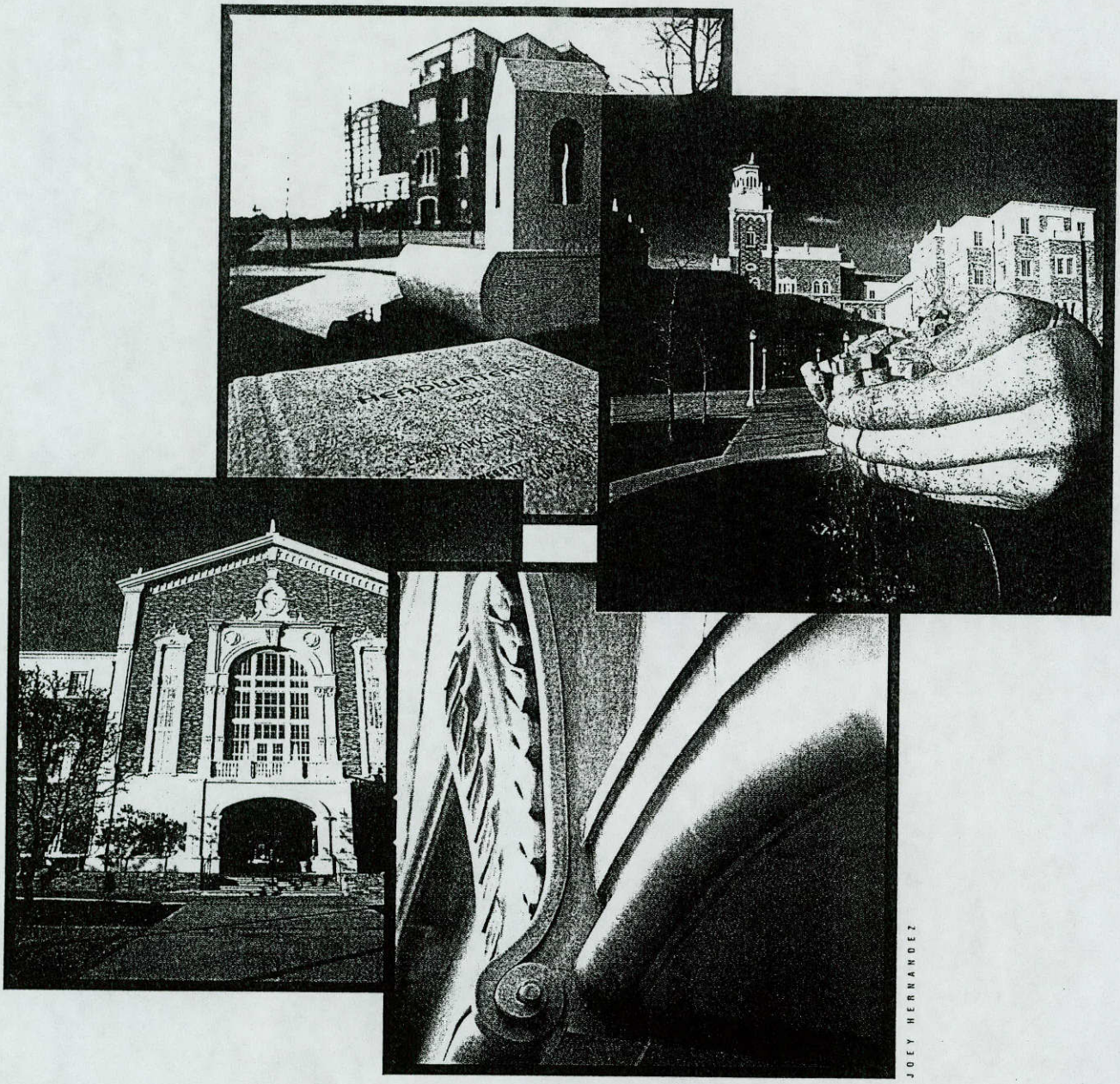
In existence since the early 1980s, NASA's Space Shuttle program, and the earlier U.S. space program involving first the Mercury, Gemini, and then the Apollo missions, have been an inspiration to millions of youngsters throughout the world. Those children have become adults who are now scientists not only in space sciences, but in numerous other disciplines as well. Our corps of astronauts and scientists are some of the best minds in the world, carrying on experiments and investigations both in the harsh environment of outer space and here on Earth in the laboratories of our universities.

Most recent missions of the Space Shuttle fleet were dedicated to building and supplying the International Space Station. By contrast, Columbia's mission was primarily scientific. Experiments aboard the shuttle included research into the mechanics of combustion, materials science, physics, cell science, human physiology and biology. Also aboard STS-107 were payloads designed by school children participating in the STARS program. At least some of the students were from Israeli schools, and they along with others from the United States, designed experiments that were conducted by the scientists of Columbia. The future of the space program has as much to do with the ideas and dreams of all children, their experiments and their chance to learn about space biology and space sciences as it does with exploration, human cooperation and extending the boundaries of knowledge.

Very late the night of the crash, C-SPAN rebroadcast a press conference from space conducted Jan. 29 by the astronauts, a composition of the "family of humans." In an eerily mesmerizing way, the astronauts of the Columbia spoke across time immemorial about their excitement, their voyage, their "wow" moments, the view from space, the thinness of the atmosphere that protects the planet we live on, their many wishes for peace and cooperation on Earth. One of the most profound comments came from the Indian-born astronaut Kalpana Chawla, who described seeing the planet Earth for the first time through the windows of the Columbia. As she spied the beautiful sphere, she also saw her own reflection in the glass, and as she looked closer, she saw the reflection of the Earth in her own eyes. Only a few have seen such a sight. We must continue to honor those lost by keeping their dreams alive, to persist in our pursuits of space and science so that we may enhance the lives of all on Earth. ←

vistas **CAMPUS SCENES**

TEXAS TECH UNIVERSITY'S NEW ENGLISH/PHILOSOPHY/EDUCATION COMPLEX opened in the summer of 2002. The complex's two buildings encompass 311,000-square-feet and was designed with the university's classic Spanish Renaissance architecture, including authentic Ludowici clay roof tile. The complex has the largest classroom space on a public university campus in Texas. The total cost for the facility is $38.4 million. The building has five computer classrooms, one observation room, two lecture halls and 40 classrooms.



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