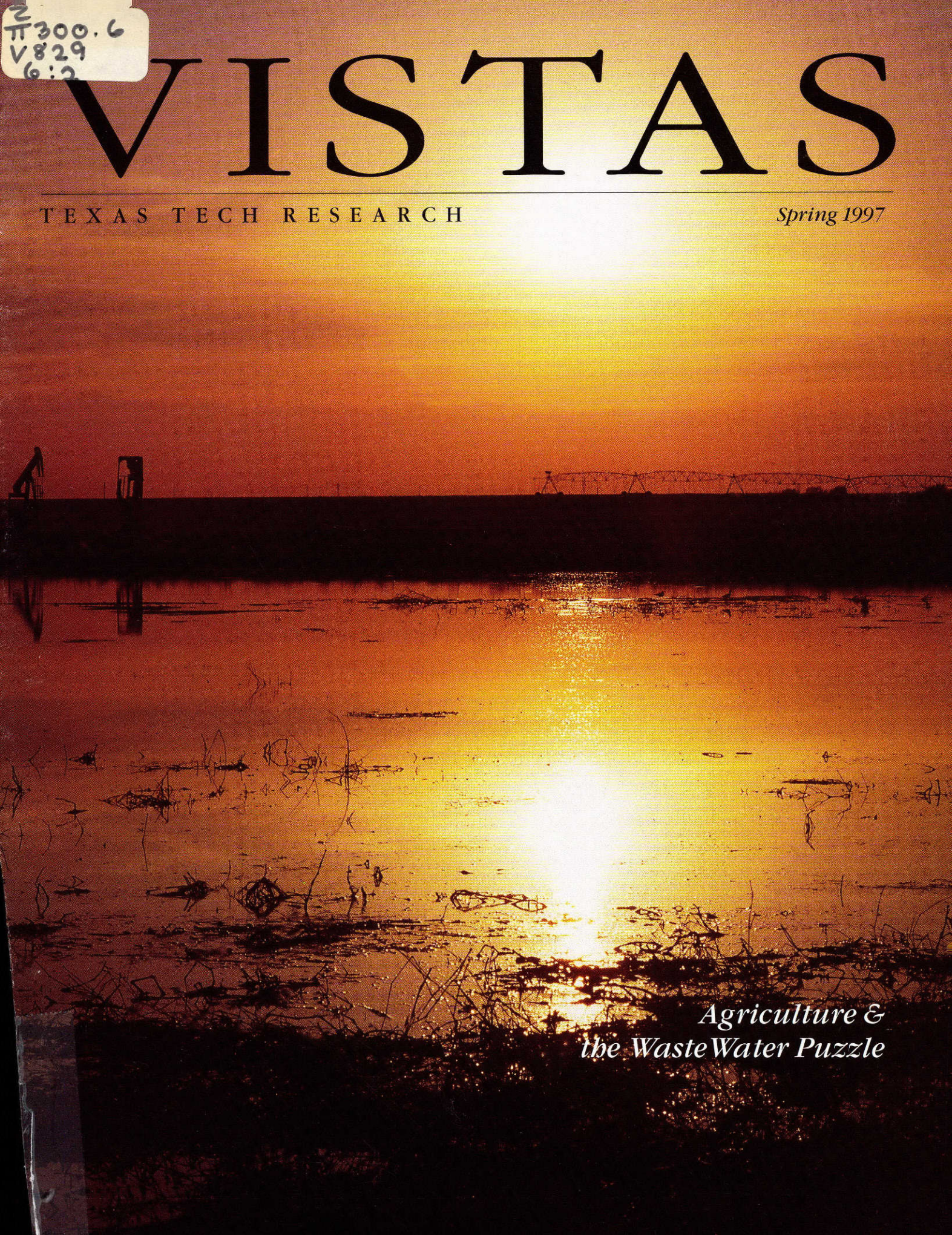
VISTAS

TEXAS TECH RESEARCH

Spring 1997



Agriculture & the Waste Water Puzzle

ABOUT THE COVERS

Front – Researchers are investigating a natural process of water purification to make water safe for human consumption before it flows to the area's playa lakes that feed the Ogallala Aquifer, an underground water source for the Great Plains. (See cover story page 8.) (Photo by Artie Limmer)

Inside Front – Robert Baker, Ph.D., marks the end of a past era and paves the way for the future as the Mammal Collection of the Natural Science Research Laboratory at the Museum of Texas Tech University chronicles the hand-cataloging of its 75,000th specimen. The collection has moved onto the information superhighway. Baker, a Horn professor of biological sciences and director of the research laboratory, explains that the vital tissues collections are from specimens of mammals, birds, reptiles, amphibians and fish and are valuable resources for documenting the physical distribution of taxa over time and for studies of environmental contaminants, pollution, disease, genetics, parasites, taxonomy and systematics. (Photo by Artie Limmer)

VISTAS

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Spring 1997 Vol. 6 No. 2

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.

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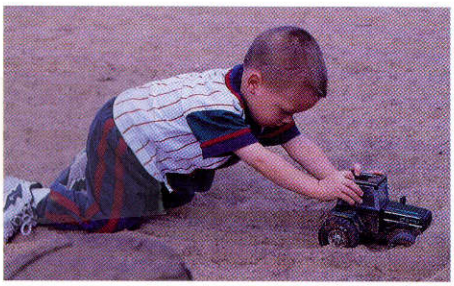

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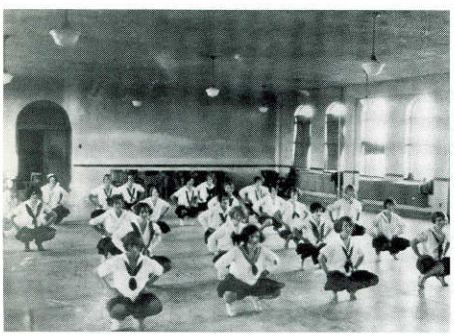

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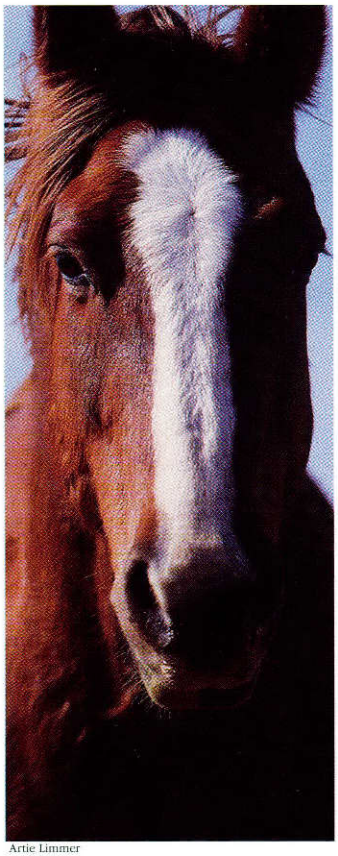
"The Broom-Tailed, Hay-Burning Sidewinders"

At one time, the place designated for the Texas Tech University horse training and research program was virtually empty. The New Deal ranch was a place so quiet that the clank of a rusty gate against its hinges would echo throughout the stables.



Artie Limmer

Texas Tech's Horse Program has wavered for the past decade but not for the lack of interest in equine research. The program has laid in waste simply for a lack of the magnificent beasts, referred to by William Faulkner as "the broom-tailed, hay-burning sidewinders."

But now, thanks to a generous gift of 22 Quarter Horses by Purina Mills, the ranch resounds with rapid hoof beats on the packed earth and students' laughter (or, sometimes, tears) as they learn to train and care for the animals.

The company made the donation last summer to help revive the program, now under the direction of Heidi Brady, Ph.D., a Texas Tech professor of animal science. The donation translates into a $53,000 gift. Add to this a renewed administrative commitment, the designation of a tenure-track position (Brady's) and student interest, and the result is a horse program with significant potential.

"I think this will greatly benefit Texas Tech because we are located in the middle of ranch country. We are building a two-way relationship with the ranching community, and it is important for us to reach out to the industry through research. We are trying to answer questions to problems that greatly affect our neighbors," Brady said.

The donated horses are top-quality and ranch-bred, says Brady. Most recently, the animals have been involved in graduate student research into reproduction and nutrition along with undergraduate horse training and breaking. Future plans include expanding research-oriented studies into the area of reproductive physiology as well as nutrition. Proposals are in place for larger classes for students (78 signed up last fall for an introductory horse course) and community outreach, supplying the ranching community with educational information as a result of the Texas Tech studies.

Students literally are lining up to take part in the horse program and to volunteer time even on the weekends to participate, according to Brady. "Texas Tech is unique in that we focus on ranch horses and the problems of ranchers. With the student interest, we could rise to be one of the top equine science programs in the nation."

A study on nutrition recently yielded results that will benefit ranchers throughout the West Texas community, Brady said. Patricia LaCasha, a graduate student pursuing a master's degree, has been using the donated horses to study different types of hay for its possible nutritional and economical value.

The researchers introduced "Matua," a new type of hay from New Zealand (where Brady worked to breed horses after finishing her doctoral degree at Texas A&M University). The hay was offered to the horses along with a coastal Bermuda variety and alfalfa. Although the horses' first choice was the alfalfa, the Matua was a close second, Brady said. Matua also was found to be acceptable in digestibility and less expensive than the other types of hay.

In another research project, Nikki Johnson, also a graduate student working on a master's degree in animal science, is using the newly donated horses to study the sexual behavior of stallions. She is looking at the effects of Regu-mate, a type of drug taken orally, on semen production and the behavior of stallions between the ages of 2 and 4.

She also is studying the horses' hormones, testosterone and estrogen, and LH, or luteinizing hormone. She is hoping to determine whether Regu-mate will suppress sexual behavior and decrease the production of testosterone in the male horses, making them easier to work with. Johnson has collected her data and is now in the process of studying the morphology of the spermatozoa.

Brady currently is investigating the short and long-term effects of this drug on the fertility of colts. Exposure of young colts to the drug may have long-lasting detrimental effects to semen production.

Although the researchers often lease horses for their studies, the Ralson-Purina donation will allow Brady to breed the mares and sell some of the colts, bringing in more funding for program operations.

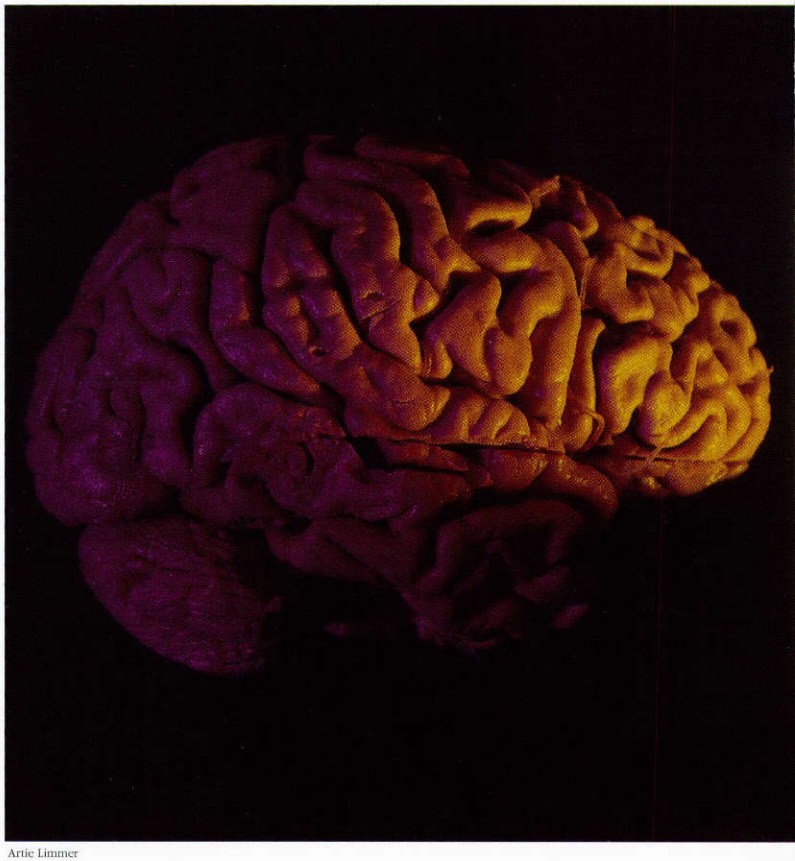
She also hopes the gift will inspire others to contribute to the program.

"Thanks to Purina, we now have an excellent teaching and production herd. But we still need donations to improve our existing facilities as well as to expand to meet our growing needs," she said, adding that the old rusty fence still needs painting.

—Janet Doggett

Controlling epilepsy

Ancient diet decreases firings of neurons



Artie Limmer

The ketogenic diet, which recently has been revived as a treatment for pediatric epilepsy, has roots that can be traced back to biblical times.

This ancient regimen, formally developed in 1921, prolongs the state of ketosis, in which acids accumulate in the body. Ketones, the acidic chemical substances developed through this process, decrease the firing of neurons in the brain and reduce seizures.

"The premise of the diet is that people with seizures do better when fasting," explains Katherine Chauncey, Ph.D., R.D, an assistant professor of family medicine at the Texas Tech University Health Sciences Center. "The key is to maintain a 4-to-1 ratio of fats to carbohydrates and proteins. For every 4 grams of fat, a patient can eat 1 gram of carbohydrate and protein combined.

"The diet is the opposite of everything we do in nutrition as far as what we market to the public," Chauncey says. "Our normal energy source in the body is glucose. The body doesn't readily burn fat. Incomplete burning of fat produces ketones. By eating a diet consisting of 80 to 90 percent fat and as little as 3 grams of carbohydrates per meal, children can enter a state of ketosis."

To begin the diet, patients must empty their body of glucose, which means fasting for three to five days, until ketosis begins. Once the change has occurred, the patient begins eating carefully measured portions of cream, fruit, meat and meat substitutes and fats. Fluids also are restricted.

For an 8-year-old child weighing 53 pounds, a typical lunch on the ketogenic diet would be 90 grams of 30 percent cream, 57 grams of hot dog, 5 grams of potato chips and 21 grams of Puritan oil, says Chauncey. She explains that to determine the number of calories for this child, the dietitian converts the child's weight into kilograms (53 pounds=24 kilograms) and then multiplies the weight by 60, reaching a daily calorie intake of 1,440 total calories. The dietitian then carefully distributes the calories among foods that will enable the child to consume the 4-to-1 ratio of fats to carbohydrates and proteins.

According to Chauncey, the diet fell out of use in the 1940s when antiepileptic drugs became readily available. Unfortunately, drug therapy used for pediatric epilepsy causes drowsiness and lethargy in some patients, resulting in developmental delay.

The Charlie Foundation to Help Cure Pediatric Epilepsy, a California-based foundation that produces a free video about the ketogenic diet, has helped the treatment make its comeback. The foundation is the brain child of a California filmmaker and his spouse, who are parents of an epileptic child named Charlie.

"Charlie's parents took him to various doctors to find treatment for the seizures, but they had little success," Chauncey says. "When the couple learned about the ketogenic diet as a possible treatment, they decided to pursue it for Charlie. It was very successful."

Daniel Hurst, M.D., professor of neurology, brought the ketogenic diet to the Texas Tech University Health Sciences Center. "Prior to coming to Texas Tech, I had never seen the ketogenic diet used successfully," he says. "When The Charlie Foundation first presented its findings two years ago, I realized that the dietitian was the key element – while I may prescribe the diet, the dietitian directs it."

Since Hurst and Chauncey began working together in January 1995, they have treated several children ranging in age from 1 year 10 months to 16 years. Two of their patients have become totally seizure-free since beginning the diet.

Despite the success of the diet, Hurst cautions that it is not for every-

body. He indicates that the diet works for about 33 percent of epilepsy cases.

"The success partially depends on what type of seizures a patient is experiencing and which type of epilepsy the person has," Hurst says. "The ketogenic diet is just one option for treating seizures that have been intractable."

"The diet is very labor-intensive for dietitians," Chauncey says. "It's not something people should try at home without medical supervision. It's important to seek help from a neurologist who is trained in the ketogenic diet."

In addition, both Hurst and Chauncey emphasize the importance of family involvement in helping the child adhere to the diet. Parents must be willing to oversee every aspect of the child's diet because strict compliance with the diet determines its success.

"When patients are on the ketogenic diet, the food they eat three times a day becomes their medication," he says.

When discussing the prescription of the ketogenic diet, Hurst quotes John M. Freeman, M.D., chief of pediatric neurology at Johns Hopkins University in Baltimore: "There is no correct dose of a given medication. The 'proper' dose of medication is the dose that completely controls the seizures without causing significant side effects."

"There is no one proper treatment of epilepsy," Hurst adds. "It's what works and agrees with the patient. If the ketogenic diet works for the patient, it is the right treatment."

—Jean Ann Cantore

PREP Successes

Elvia Gomez has an aptitude for mathematics. When she began the process of choosing a college to attend, Gomez added two important qualities to the equation: familiarity with the campus environment and networking possibilities with faculty. She decided to attend Texas Tech University, although four scholarship offers could have taken her to several other top educational institutions.

Gomez had an early start at Texas Tech as she entered a pre-college educational program, and now she is pursuing her second degree, a master's. Thanks to a program funded by GTE Service Corp., a $300,000 gift was presented in 1989 to Texas Tech to establish and award more than two dozen $12,000 scholarships to Hispanic and African-American students who completed at least two years of TexPREP-Lubbock.

TexPREP-Lubbock was established a few years earlier as a program for pre-college students who demonstrated a potential for careers in mathematics, engineering and science. The Lubbock site, which opened in 1986 and later became GTE-PREP, is one of 19 locations designated to host the PREP program that initially began in 1977 in San Antonio.

"This project was part of a national initiative that was supported by the Texas Higher Education Coordinating Board Eisenhower Mathematics and Science Program," said Charles Kellogg, Ph.D., associate professor of mathematics at Texas Tech and current director of the TexPREP Program. "Administrators of that program were looking at two potential sites in this area and they selected Texas Tech.

"Since 1986, nearly 500 students have successfully completed at least one year of the program, and about 240 students have gone on to complete the entire program," Kellogg said.

The strength of the program can be measured by the performance of its graduates upon entering college. According to Brian Yearwood, a four-year PREP science instructor, students who complete the program are better prepared for college and the demands of college life.

"A program like this opens the eyes for a lot of students," said Yearwood, an assistant principal at Cavazos Junior High School of the Lubbock Independent School District. "It gives them a real strong view of what university life is all about. It shows them that they can go to college, even though most of them probably never thought about college before joining the PREP program.

"Sitting in a college classroom is no longer a foreign concept for these students," Yearwood said.

Yearwood added that students in the program are learning how to apply classroom concepts to everyday life. He said the program teaches critical thinking and problem solving skills, essential in today's complex society.

Artie Limmer

Gomez was among the first two scholarship recipients to enter Texas Tech courtesy of GTE. As a freshman in 1991, Gomez said her exposure to the university via the program gave her an edge in the classroom.

"Texas Tech was not my first choice coming out of high school," Gomez said. "I'd been offered a full scholarship to the University of Texas at Austin and a one year scholarship to either Trinity, Vanderbilt or Duke."

Gomez also was a recipient of the Robert C. Byrd National Science Foundation Scholarship, which would have allowed her to attend the university of her choice.

Gomez, who earned a bachelor's degree in mathematics, now is a graduate student at Texas Tech working on a master's degree in statistics. Upon comple-

Early exposure to the university environment attracted Elvia Gomez (left) and Leticia De Larrosa to Texas Tech when they were in the process of choosing colleges.

tion of her bachelor's degree, Gomez came back to the PREP program as an instructor.

"When I was in the program, there were only 40 students and we weren't divided into groups," Gomez said. "The courses were set up to challenge students and we were always in a class that was at least one year higher than the current classes we were taking in public school.

"For example, if students were taking algebra, they would also take calculus. If students were taking trigonometry as their regular class, they also would take second year geometry," Gomez said. "This kind of structure really challenged us because we had to think well ahead of the level of our present classes. I think that's why I was able to do well at Texas Tech."

Gomez's success has paved the way for another PREP graduate, Leticia De Larrosa. De Larrosa, a 1994 graduate of Lubbock High School, said that Gomez has served as a poster child for the PREP program.

"When I was in the PREP program, I found the college setting to be a wonderful experience and the courses quite challenging," De Larrosa said. "I knew I was going to come to Texas Tech, and after seeing the goals that Elvia had achieved, I knew that I probably would major in mathematics, too."

De Larrosa, a junior mathematics major at Texas Tech, said the early exposure to campus life played a large role in her decision to pursue higher education.

"I felt that the instructors were very helpful and they wanted you to succeed," De Larrosa said. "In my regular classes, I was afraid to ask questions about the assignments. During PREP, I found myself wanting to ask questions and the instructors always were there to help."

Under the present TexPREP system, which is conducted during the summer months, students who participate in the program spend six hours daily attending classes, lectures and laboratories. Acceptance into the program is based upon academic ability and student desire. Students of all racial categories are solicited from school systems within a 50-mile radius of Lubbock.

TexPREP-Lubbock offers three programs: Prep I for first-year participants (seventh- and eighth-graders), Prep II for second-year students (eighth- and ninth-graders) and Prep III for third-year students (ninth- and 10th-graders).

Prep I offers courses in mathematical thought, computer science, science, engineering, research and study skills. The curriculum for Prep II offers similar courses on an advanced level in addition to courses in problem solving. Prep III provides courses in calculus, university readiness, probability and statistics, technical writing and research.

From 1986 to now, 482 students have successfully completed at least one year of TexPREP-Lubbock. Of these students, 240 have gone on to complete PREP II and 147 of the 240 have completed PREP III.

TexPREP-Lubbock is supported by the Amarillo National Resource Center for Plutonium, Amoco Oil Company, the Howard Hughes Medical Institute, the Texas Instruments Foundation and Lubbock Plant, the Texas Higher Education Coordinating Board Eisenhower Program, the State of Texas, the National Aeronautics and Space Administration, the U.S. Department of Energy, the GTE Foundation, the University of Texas at San Antonio TexPREP and the Summer Youth Employment and Training Program. Additionally, Texas Tech's College of Arts and Sciences, College of Engineering and department of mathematics contribute to the program.

"I believe any student can be a success in life if he or she is given an opportunity and a role model," Gomez said. "My role models were several members of my family who had already attended college and became successful in their professions. Because of GTE, I hope that I am able to show other students how successful they can be, too."

In addition to Gomez, Jeremiah Aguilar, also from the class of 1991, graduated from Texas Tech. The program has had other successful students, Michael McKelvy and Antroy Arreola, who declined their scholarships from GTE and completed their educations at Notre Dame University and Rice University, respectively. Eleven additional GTE-PREP scholarship recipients currently are attending Texas Tech.

"During its 11-year history, we've had some pretty good students come through and gain a wealth of knowledge and experience that will assist them in their educational endeavors," Kellogg said. "Last year we had more than 100 students in the program, and I hope to see that number continue. The best way to ensure the future of professions, such as science and mathematics, is to keep programs like this operational to help educate the next generation of professionals."

— Myrna Whitehead

VIEWPOINT

Conserving Water — *for the Long*

Term

By Kary Mathis, Ph.D.

Artie Limmer

In his State of the State Address, Gov. George W. Bush gave brief mention to working on a long-range water plan for Texas. During the coming months, it's hoped he, Lt. Gov. Bob Bullock, Sen. J.E. "Buster" Brown (R-Lake Jackson), and other state officials will agree on proposals to protect our state's most important resource.

The need to safeguard water throughout the Southwest has never been greater, and Sen. Brown has put forth a voluminous legislative proposal governing water and water rights. While the legislation is welcome and necessary, equally important is the need to emphasize water conservation. The governor and Legislature can do several things to ensure that water tables remain stable for the long term:

Brush growing on range lands needs to be controlled. The brush draws enormous amounts of water from watersheds while providing little benefit to the surrounding area. In fact, an overabundance of brush hurts deer herds. The brush is a powerful invader that sucks up available moisture, damaging edible grass. Tax incentives should be offered to encourage farmers to clear the brush. With the brush gone, the range grass would have more water and livestock and wild animals would eat better. Don't worry about erosion from brush cutting; the hearty grass will keep things in check.

Approve proposed property tax relief for farmers who use the latest and most efficient irrigation methods. Low-interest loans also would spur purchase of new irrigation equipment. In the past, farmers applied the maximum amount of water needed to ensure a good crop. Today, technology has improved to the point where water usage can be minimal while still guaranteeing a successful yield. The state should encourage all farmers to install underground pipes and have them use low energy precision application.

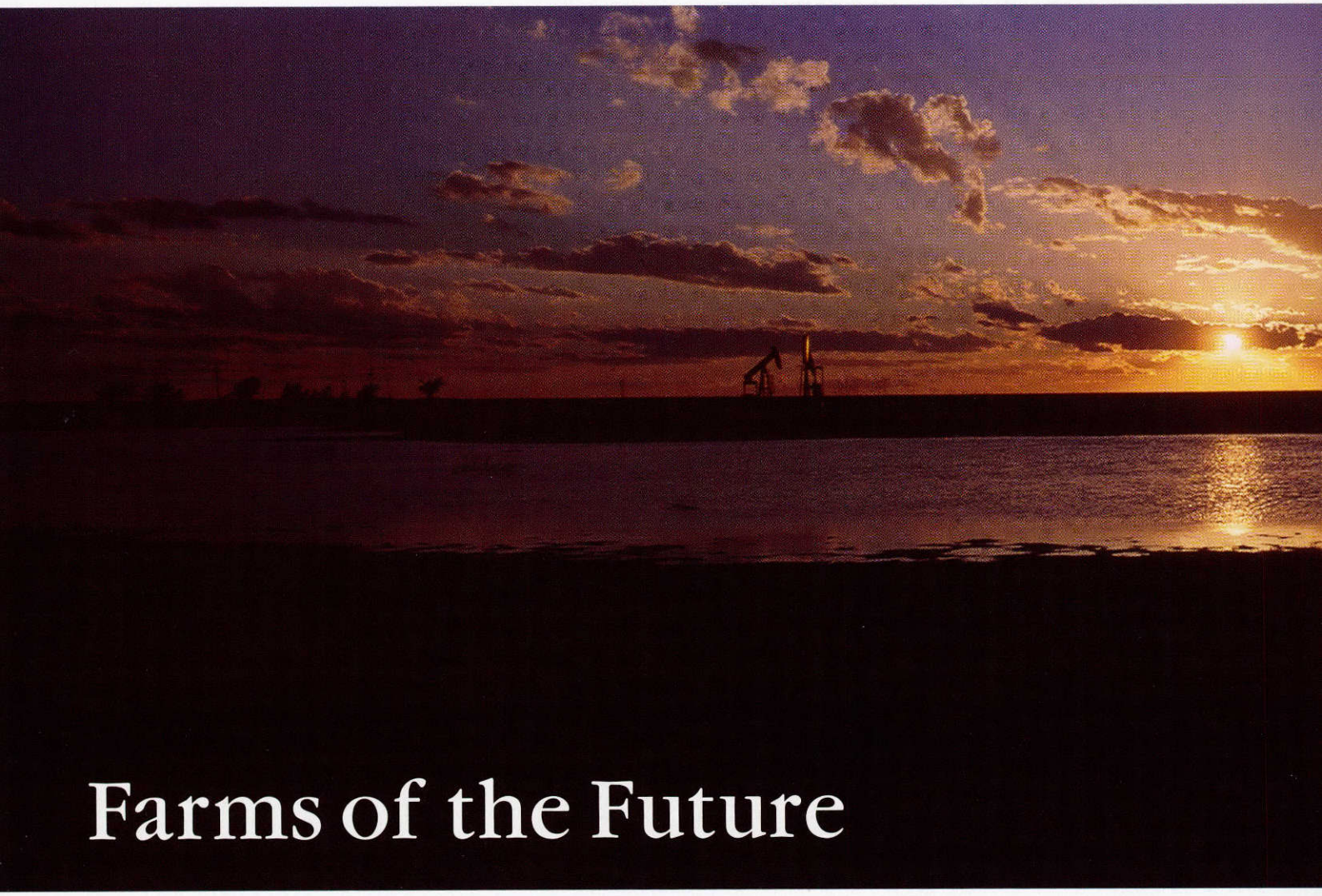
Tie industrial and residential growth to existing developments. If so-called urban sprawl must continue, then communities should ensure it is done in an orderly fashion. This means development must be concentrated. Developers cannot be allowed to glom off a piece of agricultural land to build on. Any farm land taken out of current use must be heavily taxed to discourage outlying residential growth. By limiting development to areas with existing infrastructures, the demand on water sources is minimized.

The people of Texas must be continually encouraged to conserve water. The governor likely opposes increasing the cost of water for homeowners as a conservation method. While that kind of painful measure will eventually be needed, for now there are steps towns and cities can take to reduce water demand. Just as zoning ordinances require that new bathroom toilets use less water, regulations for new homes should be amended so that only landscaping indigenous to the Southwest is installed. People new to Texas cannot expect to have the lush lawns they had up North.

"Xeriscaping" – landscaping using shrubbery and grass that needs little moisture to survive – offers homeowners pleasant looking property without the need for constant irrigation. Xeriscaping is somewhat expensive but it eventually will pay for itself in reduced water bills and time saved for upkeep. To further conservation, people who water their property during the day, when evaporation is at its peak, should be fined.

The governor said in his speech that his "fundamental priority is the education of our children." A comprehensive program approved by the Legislature should be put in place to teach youngsters just how precious water is. That's a lesson worth learning. □

(Editor's Note: This editorial is reprinted with permission from the Houston Chronicle. Kary Mathis, Ph.D., is the director of the International Center for Arid and Semiarid Land Studies and is the Thompson Professor of Agricultural Economics at Texas Tech University.)



Farms of the Future

Aquaculture Turns Waste Liabilities Into Economic Assets

By Josh Ben Allen

Leaving the house with a basket full of trash and returning with a hand full of cash would encourage any child to complete chores on time. Currently, waste is a liability that consumers must pay management companies to remove. Farmers and ranchers experience the same waste liability on a much larger scale in the form of livestock waste. Texas Tech University scientists hope to recycle livestock manure, creating a self-sustaining farm of the future.

Clifford Fedler, Ph.D., associate professor of civil engineering, and Nick Parker, Ph.D., an agricultural professor and leader of the Texas Coop-

Joey Hernandez

erative Fish and Wildlife Research Unit at Texas Tech, are building a non-mechanical, gravity-flowing purification system for livestock waste. A series of recycling ponds will take in livestock waste, separate liquids and solids, and filter waste water before it flows to an area playa lake that feeds the Ogallala Aquifer, a natural underground water source for much of the Great Plains.

Groundwater below some feedlots contains high nitrogen levels, according to High Plains Underground Water Conservation District tests. As cattle manure lays on the ground, the waste naturally separates into liquid and solid components, and the liquid can infiltrate the underground water supply.

"The nitrites and nitrates found in nitrogen are a human health risk because they combine with hemoglobin and prevent the carrying of oxygen. If nitrogen from the waste water filtrates into the groundwater, then we have a public health risk," Parker said, explaining the need for such a purification system.

In Mother Nature's natural process of water purification, microorganisms as well as plant and animal life remove nitrogen and other unwanted nutrients. In fact, the various life forms in each recycling pond of the Fedler and Parker system further purify the waste water, making it suitable for the life forms in the next pond. The waste water, now with nutrient levels safe for human consumption, returns to playa lakes and ultimately seeps into the Ogallala Aquifer.

The project, being demonstrated on the Texas Tech Farm outside of Lubbock near New Deal, is designed with three distinct ponds, two settling basins and a playa lake. Currently, a liquid-solid separator scrapes out the more fibrous waste from the 1,000-head feedlot. The remaining liquid waste flows directly to one of two identical settling ponds. From the settling pond, nature takes its course and further separates liquid from solid waste.

The remaining fluid flows into a playa lake.

With the new system, the liquid-solid separator still scrapes out the fibrous waste, but the liquid flows to the first pond. Microorganisms in the first pond make the water suitable for the plants growing in the second pond, and those plants in turn make the water suitable for the fish living in the third pond.

Within the first pond is a pit protected by four walls. The pit protects anaerobic bacteria and other microorganisms, which do not need oxygen to survive, from being stirred out of the pit by water currents. The anaerobic pit keeps water pH levels low, enabling the anaerobic microorganisms to begin digesting the waste materials.

"These microorganisms, called acidogens, break down complex carbon compounds by slicing the long carbon chains," Fedler explained. "For all of this to occur naturally, it takes time. With our pit, however, we keep the acidogens in the base of the pond, so that they have the time necessary to break down the carbon compounds."

Once broken, the compounds release smaller carbon chains out of the anaerobic pit into the larger pond, or "facultative" pond, that encompasses the pit itself.

In the facultative pond, aerobic bacteria that require higher pH levels and oxygen to survive, produce enzymes that further break down the waste's carbon chains.

Waste water flows next to the aquatic plant pond where the small carbon chains are broken up by plants that rob the waste water of nitrogen and carbon dioxide.

"Once the plants remove the nitrogen from the water, we can produce fish in the next pond: bait fish, ornamental fish and tropical fish. We can produce perfectly eatable fish, but marketing a food fish that was raised in a waste water treatment facility would not be an easy task," Parker said.

After reaching one of the two identical settling basins, the water flows to the playa lake, and some eventually seeps into the Ogallala Aquifer or is used for irrigating traditional crops. The waste water, moving through the first pond in about 20 days and through the last two ponds in about 10 days, becomes safe in about 30 days before reaching the settling basins.

Solids in the first pond, however, could take more than 500 days for the anaerobes to digest, Fedler said, noting that the exact time for solid retention will be determined by this project.

Parker and Fedler did not design the gravity-fed waste water filtration system solely because of the need to reduce nitrogen levels in groundwater under feedlots. Rather, the system's design is a culmination of several related projects.

The holistic design of the recycling pond series resulted from a number of previous aquaculture projects pieced together for the U.S. Department of Energy's Pantex Plant, a nuclear weapons facility near Amarillo.

The traditional method for modifying a waste water operation similar to Pantex's system involves installing a large network of mechanical devices, costing millions of dollars. The pond system, designed by Parker and Fedler, costs two to three time less than any mechanical system. Additional modifications to meet the rigorous environmental, security and safety standards inside the Pantex compound will increase costs, but overall, the pond system will cost about two times less than a conventional operation.

"Pantex's mechanical aeration system requires manpower to operate and maintain pumps that run continuously," Parker said. "Our system practically runs itself. We do have a pump in this system, but it could be easily designed as a totally gravity-fed system that doesn't constantly burn fuel and require continuous maintenance," Parker said.

"If we weren't designing this system to fit Pantex's current facility," Fedler interjected, "it would all be gravity-fed and would almost run itself. In upkeep, mechanical systems cost about five times as much as a natural system."

Parker and Fedler have been adding pieces to the waste water puzzle since they received their first grant together from the Economic Development Administration in 1989 to farm a type of marine algae

Plants, such as the water hyacinth, commonly are used in waste water treatment. The water hyacinth is a controlled exotic plant, requiring a license for possession.

Artie Limmer

Artie Limmer

Above: Duckweed, the world's smallest flowering plant, floats on the surface of the water. The plant, about 40 percent protein, mixes well into cattle feed. Right: Students (left to right) Chris Kimmons, Brian Swartwood and Gary Lee put in monitors during construction of the facultative pond at the New Deal farm.

Artie Limmer

in the salty waters polluting the Colorado and Red rivers. To grow, algae uses nutrients from anaerobically digested manure mixed in with the salt water. Some of the salt is removed from the water as algae is harvested.

"River authorities were looking at pumping the salt water out before it reached the rivers, but they did not know what to do with the water," Fedler said. "We proposed farming algae at a much lower cost than pumping the water out to reduce salt levels.

"In addition to reducing salt levels, algae also is the basis for many pharmaceutical products. Suddenly, our salt liability has become an algae asset. That was the first time we began thinking of using aquaculture for nutrient reduction."

Parker and Fedler discovered through another project that they could use livestock waste to create energy, which in turn could be used to sustain greenhouse plants that further reduce waste water's unwanted nutrients.

From the beginning of their research, Parker and Fedler thought of aquaculture but recognized it as only part of the waste water puzzle. They began making use of the pieces created from the pond system itself.

"Cattle take in grain and feed as inputs," Parker said. "A small amount of that feed remains in the cattle as nutrients. The rest ends up as cattle waste. That costs producers. If we can take that waste and put it in a digester, what can we get out of it besides safer groundwater?"

As the acidogens in the anaerobic pit slice through the large carbon chains, energy is released in the form of biogas, which is methane with about 40 percent carbon dioxide. Over the anaerobic pit, Fedler and Parker have designed a greenhouse-type bubble to capture the biogas.

"Biogas can be burned to heat water and produce steam. In our system, that heat can be used in turn to help process the corn used for cattle feed," Parker said. To make corn easier to digest, producers heat it with steam and flake it using a press.

"When we burn that biogas to flake the corn, we will have heat or steam," Parker continued. "We also can capture the hot exhaust gasses and use them to heat the anaerobic pond, which will increase the ability to produce more biogas.

"In fact, we could ferment the corn, bottle the ethanol and still have the corn for cattle feed. The heat and the ethanol from the fermentation process could be recycled into heating on-site greenhouses or the anaerobic pit itself. As we increase the temperature in the pit, the digestion process speeds up."

"Given all of the possibilities of this treatment system, it looks pretty advantageous to a producer wanting to do something before regulators dictate something much more expensive."

By capturing the carbon dioxide from the initial stages of digestion that normally would be going into the atmosphere, a livestock producer can use the carbon dioxide to harvest and sell plants. For example, a cattle producer could grow 1 pound of algae with 2 pounds of carbon dioxide, according to Fedler.

Including algae, other plants that thrive from water treated in the fist pond are duckweed and water lilies.

"A four-inch pot of some ornamental water lilies sells for $69.95. We have producers in Texas that export water lilies around the world," Parker said. "Why couldn't West Texas producers do the same? These are the kinds of value-added products a cattle producer might create from this waste water system."

Duckweed is the world's smallest flowering plant and floats on the surface of water. It would be found in playa lakes except the region's wind blows it out of the water. With a pond protected by a greenhouse-type cover, a producer simply skims the duckweed off the surface of the water. Duckweed is about 40 percent protein and mixes well into cattle feed, much like soybean.

"If you have an alternative to high-priced hay, cattle producers could become interested. You can see how cattle producers would be more interested in duckweed than algae," Parker said. "When the demand for algae becomes large enough for processing plants, then producers might be more interested in producing algae."

To create an algae market, algae producers could process the feedlot waste water, Parker noted. At first, livestock producers would have to pay for the waste water service. But as the algae industry grows and the competition demands, algae producers might have to pay farmers for their waste needed to harvest algae.

"Cattle producers want to move into something they are comfortable with. That's why we moved into duckweed and water lilies. These plants are more familiar to us and easier to produce," Parker said. "Now, we have turned a farmer's liability into an asset that brings in cash."

"It's not easy to get people to change. Change only comes when something is economically advantageous for them to do so," Fedler added. "Given all of the possibilities of this treatment system, it looks pretty advantageous to a producer wanting to do something before regulators dictate something much more expensive."

Fedler and Parker think it is only a matter of time before feedlots begin adopting their waste water treatment system because the pressures on aquatic resources are too great not to adopt such recycling methods.

The feedlot at Texas Tech's Burnett Center provides a tremendous amount of exposure to demonstrate the system. Visitors from around the country and world tour Texas Tech's Farm in New Deal, Fedler said. Visitors will see

Artie Limmer

The Talapia, or St. Peter's fish, grows rapidly and is tolerant of harsh environmental conditions. In each recycling pond, the various life forms further purify the waste water.

the waste water treatment system in various stages of operation as Fedler and Parker make necessary adjustments.

"Because we have designed so many samplers into this system, we will know exactly where to take corrective action," Parker said.

The samplers on the bottom side of the anaerobic pond will answer the question of how much waste water sinks into ground water from the bottom of the pond, a question that has never been definitively answered, Fedler said. Answering that question is the primary reason the Environmental Protection Agency decided to help fund the waste water project.

The EPA currently requires 2 feet of packed clay for waste water ponds, but Fedler's initial tests outside of the pond show that about six inches of manure will seal the pond.

"We need to run a few more tests before putting manure in that first pond and pouring water on top. Once that happens, there is no turning back without draining the pond," he said.

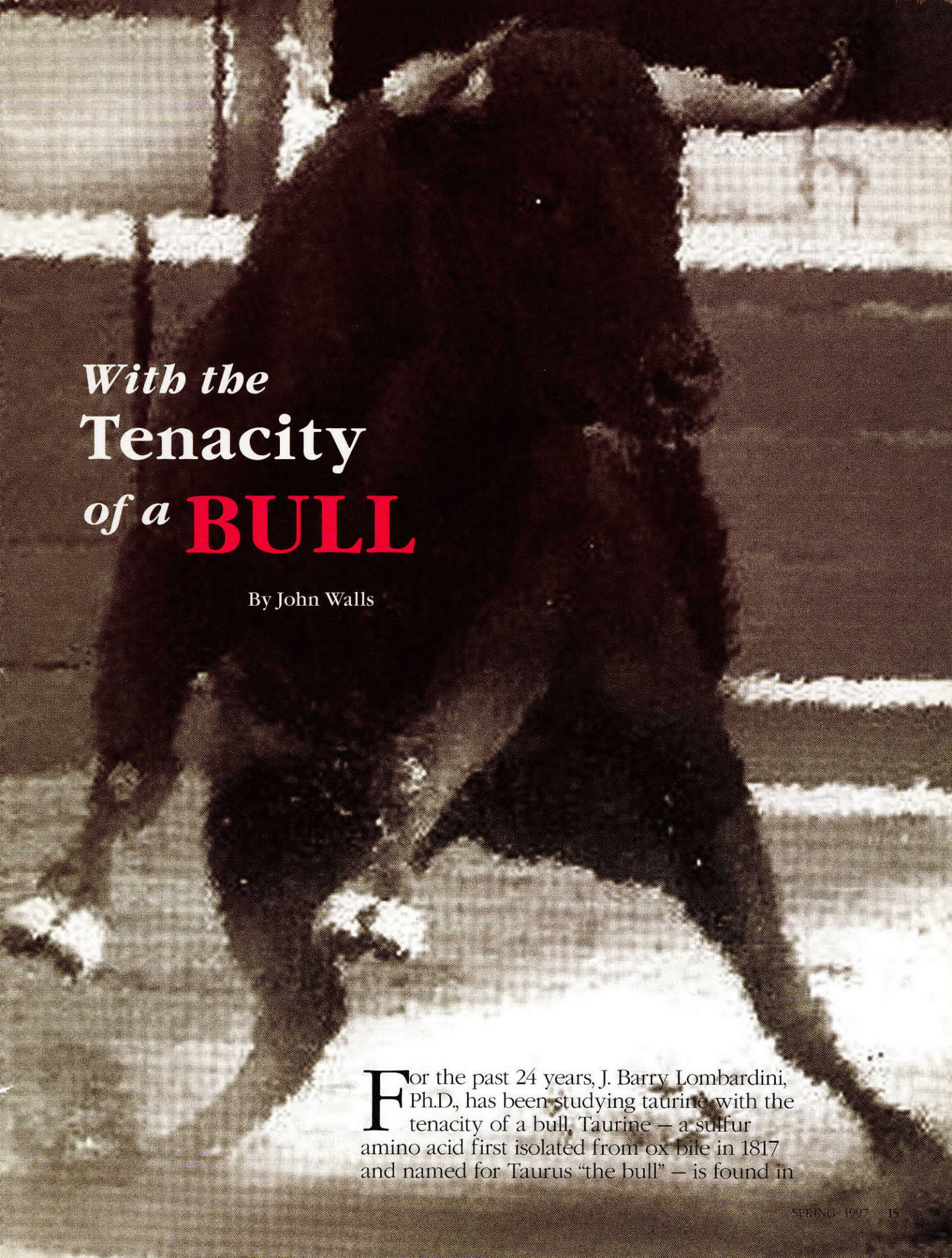
The second selling point for the EPA was the operation of the system itself. EPA officials liked the design of the pit to protect the anaerobes and provide the nutrients to grow micro-algae and purple sulfur bacteria in the surrounding pond, Fedler said.

The third component that convinced the EPA was the economic benefits of combining agriculture and aquaculture. Fedler and Parker hope to sell livestock producers on the system in much the same way. But before they begin promoting the product as an asset to farmers and ranchers, unanswered questions need to be addressed.

"We need to know how much waste material is going to end up in the biogas system. Of the waste that goes in, we need to know how much is going to come out," Fedler said.

"This type of a pond system has never been used for livestock waste. We are going to be determining the numbers for solid breakdown times and the total amount of breakdown achieved. Those are numbers we won't have until we get five years worth of performance out of the system. Once we know the mass balance of the system, we can do a true economic analysis."

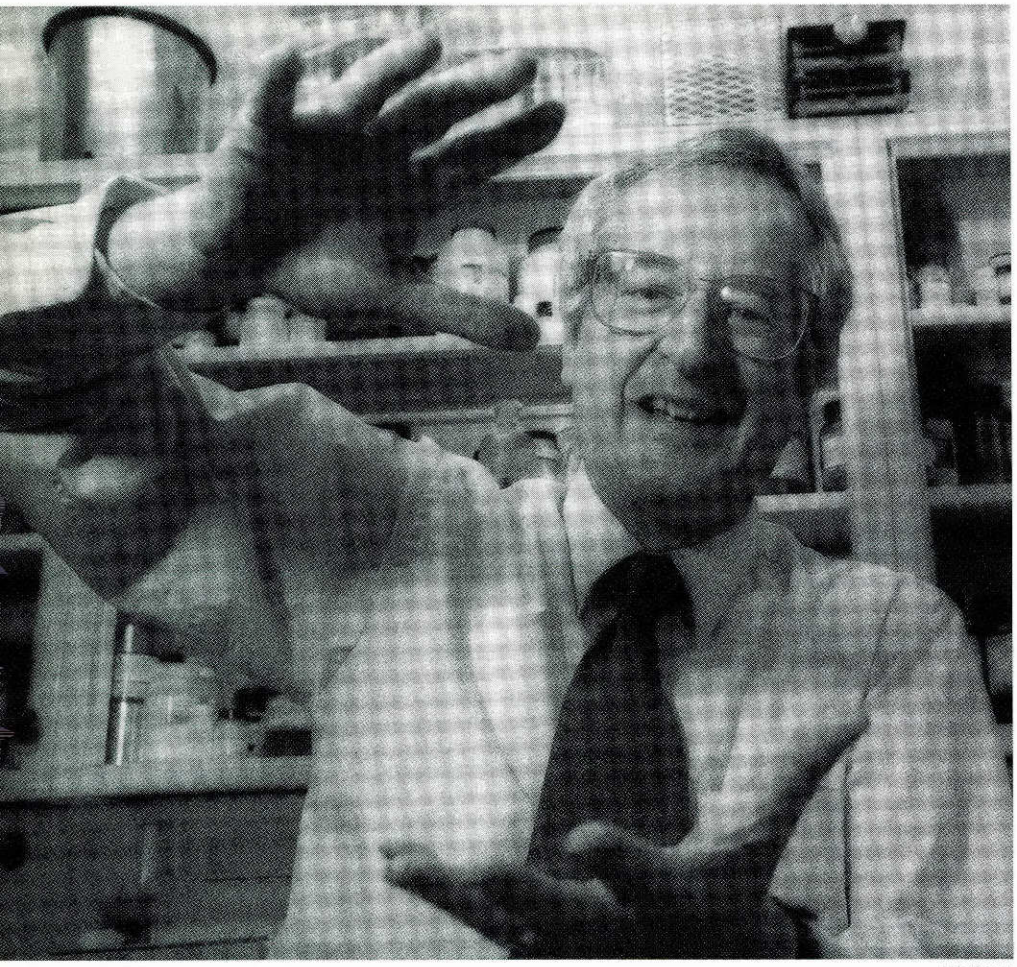
With an economic analysis in hand, Fedler and Parker can market their waste water treatment system as economically advantageous to livestock producers. Similarly, if consumers could compost all of their trash, making use of the byproducts produced, then trash could serve as the basis for a cycle of energy, products, and then more trash — turning a liability into an asset. □



With the Tenacity *of a* BULL

By John Walls

For the past 24 years, J. Barry Lombardini, Ph.D., has been studying taurine with the tenacity of a bull. Taurine – a sulfur amino acid first isolated from ox bile in 1817 and named for Taurus "the bull" – is found in



Artie Limmer

For 24 years, J. Barry Lombardini, Ph.D., has been studying taurine, a sulfur amino acid essential for animals.

all of the animal kingdom, but it is not evident in the plant kingdom. Lombardini is searching for the role of this sulfur amino acid in regulating cardiac and retinal function. Mammal heart and retina tissues are especially high in taurine.

"Taurine is floating around free in the body, and in some tissues like the heart it composes more than 50 percent of the free amino acids in the cytoplasm," Lombardini explained.

A review of literature notes that taurine is essential for animals, he said. Studies in the 1970s demonstrated that some cats, given synthetic diets, began having retinal damage which progressed to blindness after about one month. The cause, Lombardini said, was a lack of taurine in the diet and the cats' inability to synthesize taurine.

"This pathology was noticed because the investigators who were doing the testing were electrophysiologists. These researchers noted that taurine-depleted cats, when adapted to the dark, showed an altered physiological reaction to flashes of light. These retinal waves – which are referred to as an electroretinogram – were attenuated or were flatter in those cats without taurine in their diets," Lombardini said. "By putting taurine back into the diet, researchers found that they could reverse the abnormal electrophysiological changes, such as the flat line in the electroretinogram, and the animals did not go blind."

One scientist found that cats also developed cardiovascular problems if taurine was absent from the diet. A researcher in the late 1980s was noticing in his veterinarian clinic cats with severe cardiac disease. "These were house cats that never got outside – usually elderly people had these cats. One day the cats appeared fine, and then one day later they would be quite ill with congestive heart failure," Lombardini said.

"All that was known was that these house cats were only getting canned or dry cat food from the store. They had no chance to eat mice, birds or insects. The store-bought food had no taurine in it – the amino acid was eliminated during the production of the food."

Once taurine was replaced in the diet, though, the pathology was reversed and the cats apparently were cured.

A lack of taurine also might be a problem with human beings because, like the cat, humans do not synthesize taurine. However, making humans deficient in taurine is very difficult. "Remember, taurine is found everywhere in the animal kingdom. So unless you are a true vegetarian and eat nothing but vegetables and no dairy products – because they contain high concentrations of taurine – it's very difficult to become taurine deficient," he said.

"In addition, humans conserve taurine, so if I put you on a taurine-free diet for six months, you'll try to conserve every bit of taurine that you have in your body. If you are on a normal diet, however, and you are taking in taurine everyday, you will be excreting it everyday."

In 1985, one researcher at the University of California at Los Angeles had several pediatric

patients that were on long-term total parenteral nutrition diets because these children had severe digestive problems. The children, given solutions for their nutrition that were devoid of taurine, suffered abnormal electroretinograms similar to those found in cats, Lombardini said. Once taurine was placed in the synthetic diet, the abnormal electrophysiology returned to normal in about 75 to 80 percent of the children, he said.

"Up until this time, the U.S. Food and Drug Administration regulations stated that infant formula companies could not add taurine to any food substance because there was no scientific reason to do so. There is no apparent function for this sulfur amino acid, even though it is a natural component of the cell, so the government said. Consequently, companies would make infant formula, isolate the needed protein from the whole milk but then discard the taurine.

"If you look at all your infant formulas now, you'll see taurine is added to them," Lombardini said.

Lombardini's research with rats applies questions about taurine to the human body. "Numerous studies have demonstrated that taurine has an effect on calcium regulation in the mammalian cell. What is calcium good for? Well, calcium has a wide range of functions. It is required for blood coagulation, cardiac and skeletal muscle contraction and nerve transmission and function. Taurine also has an effect on the phosphorylation of proteins. Phosphorylation is when one of the amino acids in the protein adds a phosphate group."

By using the rat as a model, Lombardini is studying the effects of taurine on both calcium ion uptake and protein phosphorylation in retinal tissue. The goal of these studies is to determine if there is a causal effect between the phosphorylation of specific retinal and cardiac proteins and calcium ion uptake.

"Preliminary studies utilizing retinal tissue from the rat have demonstrated that taurine and various analogues of taurine – compounds with a similar, related structure – have a stimulatory effect on calcium ion uptake but have an inhibitory effect on the protein phosphorylation of specific retinal proteins," Lombardini said. "Analogues of taurine that have no effect on calcium ion uptake were also demonstrated to be inactive in the protein phosphorylation system. These observations of an inverse relationship for taurine and its structural analogues thus suggest a causal relationship between protein phosphorylation and calcium ion uptake," he said. The precise nature of this relationship and involvement of taurine in the visual process remains to be demonstrated, and thus the research continues.

"This is an exciting discovery because this enzyme is a significant component of the mitochondria of cells and is necessary for energy production in the cell."

"Experiments are also in progress to isolate and purify one of the retinal proteins whose phosphorylation is inhibited by taurine. This retinal protein will be analyzed for its amino acid sequence, which then will tell us with the aid of protein libraries if it is a known protein and what its function is. If it is not a known protein, then an ultimate goal, but a considerably more difficult one, will be to determine its function," Lombardini said.

A recent result from Lombardini's studies is that one of the cardiac proteins whose phosphorylation is affected by taurine appears to be pyruvate dehydrogenase, an important enzyme in cellular metabolism.

"This is an exciting discovery because this enzyme is a significant component of the mitochondria of cells and is necessary for energy production in the cell," he said.

Lombardini already has applied his knowledge of taurine to other research projects. In a previous project, Lombardini hypothesized that, because of the high levels of taurine in cardiac tissue, trauma to the heart would increase taurine levels in the patient's blood. Working with a cardiologist, Lombardini performed a series of patient studies.

"In the hospital emergency room, I obtained blood samples from patients who were being admitted due to chest pains. After checking for taurine levels, I could predict whether this person had a heart attack instead of someone who had chest pain due to skeletal muscle trauma or gallbladder attack or gastrointestinal pain. My cardiologist collaborator would then look up his records, and we would compare notes. I could tell which patients had heart attacks because of the elevated taurine level in their plasma. Damage to the heart muscle was liberating the taurine from the cardiac cells to the blood," Lombardini said.

"A drug company contacted me concerning these results to determine if measuring blood taurine levels would be a diagnostic test for heart attack patients, but unfortunately measuring taurine levels wasn't going to be any better of a diagnostic test than the LDH or CPK enzyme assays which have been around for 30 to 50 years."

In the future, Lombardini said, it is possible that taurine may become a supplement just like some people use vitamins for supplements. "You can buy taurine tablets in the health food store right now, but if you ask what it is good for, managers generally don't know.

"Perhaps if an individual is susceptible to some retinal pathology or cardiovascular problem and the taurine content of their tissues is very low for some unknown reason, maybe then their diet could use taurine supplementation."

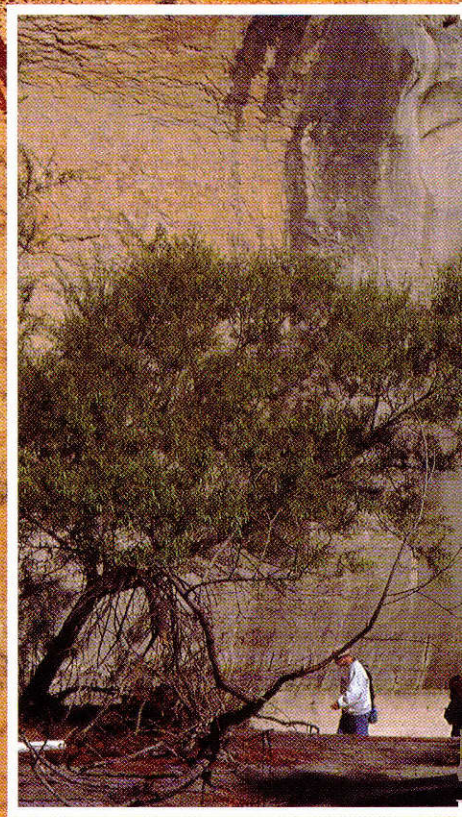
Working with grant funding from the RGK Foundation in Austin, Lombardini continues his investigation of taurine. Even after more than 20 years of studies, Lombardini's enthusiasm for his research has not dimmed.

"The stock market may go up or down, but as far as taurine goes, it is always a bull market," Lombardini said. □

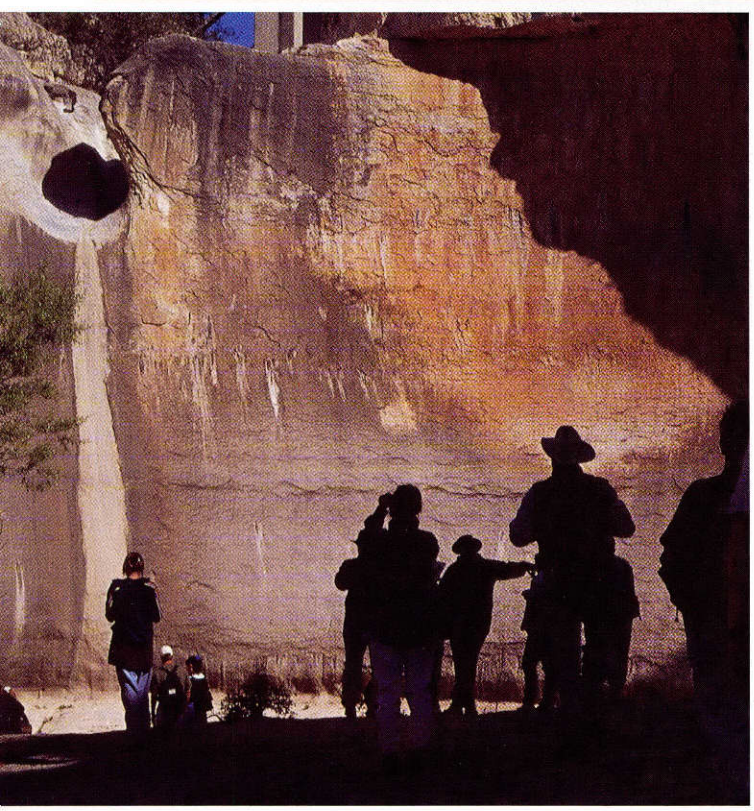
Ancient Images

By Kippra D. Hopper

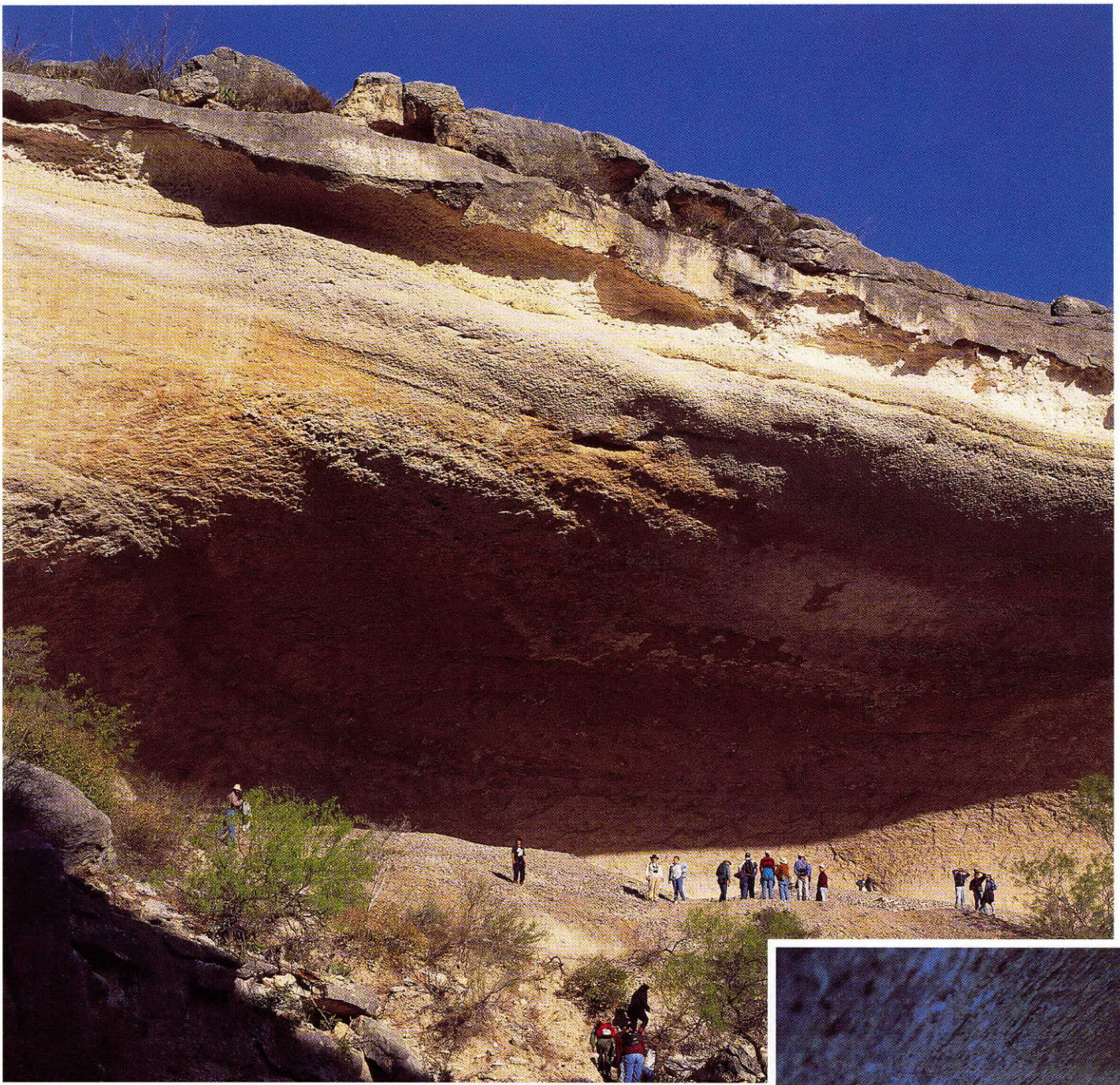
Photos by Mark Mamawal

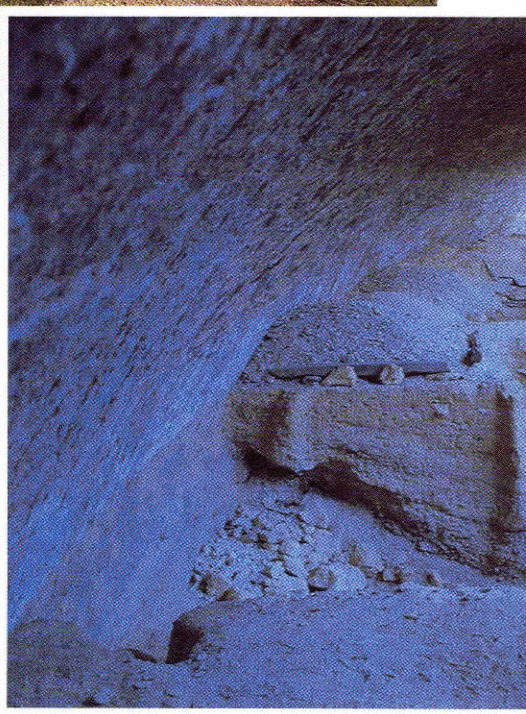


Archeologists ponder rock art of the Trans Pecos



Hiking through Skiles Ranch toward Eagle's Nest in a canyon of massive proportions, we climb over limestone boulders and around tinajas, the natural depressions in the rock that collect rain water. In a place like this, human beings are reminded of their insignificant size. We are here to see the images left behind by ancient peoples on the walls of caves: shamanic figures, deer, mountain lions, raccoon, catfish, cacti, bows and arrows .... Not knowing exactly what the pictographs mean, we sense that the art reveals something eternally important. The shelters visited – named Fate Bell, White Shaman, Rattlesnake Cave, Panther Cave, Eagle Cave and Bonfire – undoubtedly are



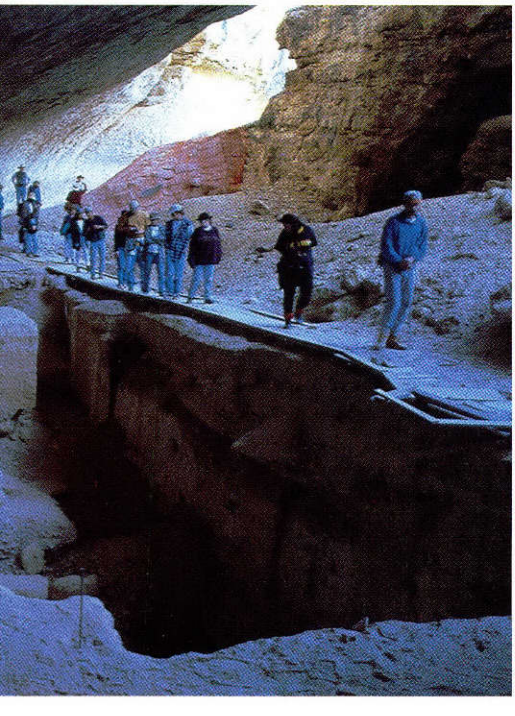


prodigious. They are nothing less than sacred sites. Each of the hikers dreams a different vision during the nights that follow about the meanings of the "Rabbit Man," "Giant Centipede" and the "Great White Shaman." The visions are imbedded in our minds, even as their impressions wear away from the rocks . . . and we struggle for the ability to keep and see them forever.

Every spring, for the past seven years, Grant Hall, Ph.D., has taken his students to these primitive sites where they can view drawings on the walls of rock shelters along the Lower Pecos River and the Rio Grande, near the Texas-Mexico border.

In hues of red, brown, black and ocher, overlapping images depict scenes of human figures, animals and various shapes and symbols of uncertain meaning. Viewing the rock art murals, which date back more than 4,000 years, one senses both the historic significance of the markings and the present urgency to find methods of preserving such precious reflections.

Hall, an associate professor of archeology at Texas Tech Univer-



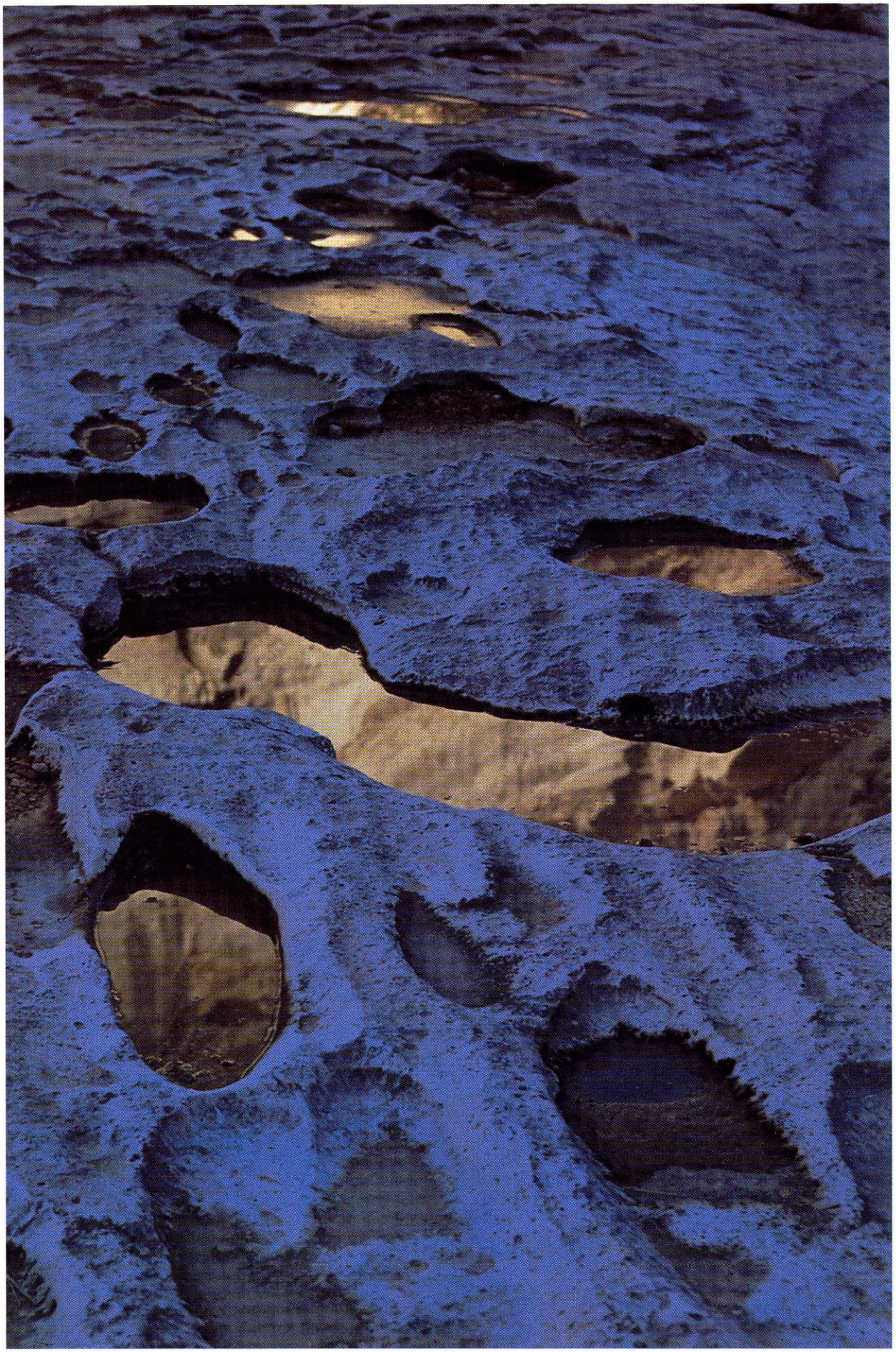
sity, recognizes the rare learning opportunity provided to the students who trek with him to the rock art sites. "Those caves and the canyons down there are just awe-inspiring. You go into Seminole Canyon and you look up at Fate Bell Shelter and see all the burned rock that was generated by the activities of prehistoric people. It's really awesome," he says.

Another site in the Trans Pecos region is Rattlesnake Canyon, a valuable resource belonging to Texas Tech. Through the stewardship of the Texas Tech Museum and Director Gary Edson, Rattlesnake Canyon has been a consequential teaching and research resource for archeologists, biologists, zoologists, historians and artists since it was donated to the university in 1984.

"The prehistoric archeology is so visible, so tangible. There's this very rough terrain, the deep, rocky canyons. It's just very picturesque. And in those canyons, there are these incredible rock shelters with the prehistoric rock art along the walls," Hall says.

Early interpretations of symbols of the Lower Pecos River involved the general idea that the main figures in the rock art represented shamans who probably went into trances in order to voyage into the spirit world. More recent analyses suggest that shamans most likely ingested psychoactive plants, such as jimson weed and peyote, found in the region before creating the images inspired by their hallucinations on the shelter walls.

Artist, muralist and archeologist Carolyn E. Boyd of Texas A&M University has studied the mystic



"People are starting to realize the significance of the rock art there. This is world-class art we have in our hands."

art of the canyons for more than five years and suggests strong parallels between the Pecos River art and that of the Huichol people of Mexico. Often called the peyote tribe, the Huichol people believed in a divinity that was half-deer and half-human who brought upon their antlers the potent hallucinogenic peyote plant.

"We're looking at her interpretations, and they are a lot more satisfying than some of the earlier interpretations, which were pretty vague," Hall says.

"Her ideas fit more generally with other interpretations that have been suggested, even with Mayans who had shamanic religious beliefs."

Ironically, the rock art having existed for thousands of years now is in jeopardy of disappearing in a very short period of time. Since the building of Amistad Reservoir in 1969, the humidity in the caves greatly has increased, causing the images to deteriorate at an accelerated rate. Scholars desperately are trying to find methods for preserving the images.

"So far no one has come up with any real satisfactory solutions for long-term stabilization. Texas Tech's stewardship of the Rattlesnake Canyon property has been beneficial though," Hall says. "It's a wonderful resource that Texas Tech has."

The Rock Art Task Force of the Texas Archeological Society in the early 1990s conducted a very careful recording of the Rattlesnake Cave images.

"In the interim until someone can find a way to stabilize the paintings, this is the best that can be done. This kind of documentation, with measured sketches, verbal descriptions and a very complete photographic documentation is the best that we can do," Hall says.

Taken as a whole, the pictographs of the Trans Pecos are perhaps the earliest, most comprehensive body of prehistoric art in the New World. "People are starting to realize the significance of the rock art there. This is world-class art we have in our hands." □

An Opportunity to Play

Melissa Frazier

Above: Catherine Swindle guides her brother Ben down the slide at Toddler Hill, an area especially designed for safety. Opposite page, top: Ben Swindle can play with abandon at the Outdoor Learning Environment. Bottom: Ashley Birdwell dances atop the climbing structure, created for balance.

By Charles Griffin

During most sunny afternoons, Aaron, an outgoing 5-year-old boy, is immersed in a world of invention, restrained only by his imagination and spirit. As wind drifts through his hair, Aaron shuts his eyes, and with each pump of a swing he draws the tips of his toes closer to the heavens. He builds, then crushes, sand empires like a Roman czar and achieves speeds on a tricycle that makes his mother cringe. Aaron is unique because he has cerebral palsy, a disorder of the nervous system that has left his legs paralyzed.

Almost everyone has fond memories of spending days on a favorite playground as a child. However, most people probably cannot recall playing with schoolmates with special needs, or playing on a playground specially designed for safety and social interaction as well as mental and physical growth.

While some children still may get a little bruise or a scratch during a hard day's play, a playground designed by an interdisciplinary team of scholars at Texas Tech University virtually guarantees the only tooth a child will loose is through natural progression.

Knowing Aaron is safe and that he does not feel different from other children are principal concerns of Aaron's mother, Marjie Collins. "I know he looks at all of the other children running and playing and he feels sad he can't do that. But at least in the Outdoor Learning Environment he is a part of the things they are doing," Collins said.

In fact, she notes, Aaron frequently plays alongside his twin brother Austin, who is not quite as extroverted as Aaron, and who is developing typically. "There is no other program

Joey Hernandez

in town that has accommodations for both Aaron and Austin. It's really exciting that Aaron has the opportunity to play on the same equipment with his brother and other children," Collins said.

"Playgrounds constructed 20 to 30 years ago and the Outdoor Learning Environment have little in common," said Cathy Nathan, director of the Child Development Research Center. She admits the merry-go-rounds children once used to propel themselves at hastened speeds were great fun and that towering slides could be alluring. However, she said emphatically, "There is no comparison between the safety and play value of traditional equipment and the equipment designed for the learning environment."

A traffic jam brought a need for playground modifications to the forefront. About four years ago the University Space Committee enclosed the grounds, blocking-off sidewalks used as a tricycle path. Congestion where the sidewalks crossed created a hazard for infants and toddlers who play in the learning environment as well as for the older tricycle riders.

"Our original plan was to buy an infant/toddler structure and place it in a protected area within the environment. However, once the interdisciplinary design team began discussing the new structure, we decided we might as well do this thing right," Nathan said. "We particularly wanted something designed for the very young child because most public and school playgrounds are designed for older kids."

The interdisciplinary team consists of Nathan; David Driskill, director of the children's resource lab in the College of Architecture; Jackie Driskill, early child life coordinator in human development and family studies; and Robert Weber, Ed.D., coordinator of adapted physical education. Other contributors are Dewey Shroyer, director of grounds maintenance; and Jim Dempsey, Ph.D., from

Melissa Frazier

Joey Hernandez

Ellen Airhart experiences the joys of sand in the playhouse, a favorite spot of the youngsters.

the Arlington company Grounds for Play.

Nathan said the design team's goals are to create a developmentally appropriate environment for the birth to age 6 population, to integrate children with disabilities and to make the playground aesthetically pleasing.

"Safety is the primary issue," said Associate Professor David Driskill. "Probably the most important issue is fall surfaces, such as the rubber, wood chip and sand surfaces used throughout the center's playground to prevent serious injuries."

The infant and toddler area rests upon an unusual synthetic surface made from recycled tires. The surfacing is soft and spongy, giving added protection for the center's youngest children. Layers of gravel, dirt, landscaping cloth and 8 to 10 inches of wood chips were placed throughout the remainder of the playground to prevent injuries to older children.

Eight children with disabilities currently are enrolled in the center. Nathan said children with special needs prompted faculty members to make the playground more accessible. "The center's philosophy is that children should be able to do anything outside that they can do inside. They should be able to pretend, climb and develop their motor skills," Nathan said.

"We know that Aaron cannot walk, and he never will walk. However, that does not mean he cannot play on the same equipment or in the same places as other children," Nathan said.

Unlike many playgrounds, the learning environment has designed and fully integrated equipment for children with special needs. At the Texas Tech center, modifications have been made to accommodate children with disabilities in every area of the learning environment. Handgrips and a ramp allow children with handicaps to play independently on the center's climbing structure. Equipment designed for those without the use of their lower

Melissa Frazier

Even after an occasional fall, Ashley Birdwell remains safe on the tube slide.

extremities, such as an upper body swing, stand among customary playground apparatus. A "Ready Racer" was purchased so children with restricted abilities can motor around the tricycle path with others.

"We are trying to develop an acceptance for one another. Disabilities are not something to be ashamed of or to try to hide. They are just part of life," Nathan said.

The playground also encourages active and social interaction among toddlers and infants through "zones." These spaces and activity centers are specifically designed to avoid putting children in awkward social settings while encouraging them to play together, Driskill said.

For instance, a slide on a traditional playground often offers only two means of descent, sliding down the slide or climbing down a ladder clad with peers. A child who makes the climb and subsequently chooses not to slide could be placed in an uncomfortable situation. Making the slide less intimidating, providing alternate exits or offering a larger selection of activities could save a child embarrassment and ridicule from his or her more daring playmates.

In addition, many children can play together in a zone. For example, toddlers often interact with one another while playing with water tables in sand areas. Others motor around on the tricycle path or climb berms together.

"The playground's zones are the environment's most unique characteristic," Driskill said. "The environment is not like a playground, it's zoned into different areas with different kinds of surfaces and characteristics. So even though it's within one fence, there really is a variety of places for children to share different experiences," he said.

Some of the zones include a nature zone, climbing, swinging and sand areas, a trike path, as well as a berm and a toddler zone. However, some of the zones are not complete.

The infants and toddlers play in a partially enclosed zone. A "developmental barrier," or an interactive wall with fitted moveable objects for children to play with, partitions the toddler zone from the remainder of the playground. "The barrier keeps the preschoolers from running over the younger children," Nathan said. "The toddlers and older children, however, can interact by playing together along the fence with bells and a peek-a-boo window."

Open spaces along the wall are for a planned diaper changing station and storage units. Nathan said the changing station will permit teachers to continue supervising the playground while attending to infants.

While the playground has zones for physical activities such as climbing and swinging, Driskill said, future storage units will house tricycles and smaller toys. For example, kids could come to the units and find shovels for planting seeds in the nature zone or for playing in the sand, he said.

The design team also is planning an amphitheater. Once a stage is in place, the children will be able to act out and attend dramatic productions. Driskill said the area also may be used for all-day exhibitions and demonstrations, such as a petting zoo. The newly constructed "toddler hill" has a slide built into a grassy hill and a cargo net for climbing and grass on the other side for rolling down.

"I believe the project is a success although some portions are unfinished," Nathan said. "Observing children's behavior is one way we as professionals can evaluate whether the environment is working. When they are out there we have very few problems. The children do not want to leave in the afternoon. That tells me it is working."

The collaborative effort among Texas Tech faculty, staff and students made such a complete playground possible.

"Once completed, the coalition of perspectives and ideas will provide an area that meets the needs of the children, their families and our students," said Nathan.

Members of the design team and the College of Human Sciences attribute much of the playground's success to the $158,000 contributed by friends of the college. Many of the donors have been honored with bricks around the sundial within the playground or a plaque inside the Child Development Research Center Cottage. The most recent gift, a grant of $30,000 from the Ronald McDonald House Charities, will allow the center to complete and maintain the environment.

Such benevolence certainly is ensuring the possibility of fond memories of swinging toward the tops of trees, soaring in experiences of play yearned for by all children. □

Mission, Risk, Change

What the Past Suggests for the Future

By Mary Jane Hurst, Ph.D.

Courtesy Southwest Collection

Above: An early photograph shows the Administration Building before wings were added. Opposite page: Almost three-fourths of the original faculty remained at Texas Tech for their entire careers.

Even during the sparsely populated frontier days of the 19th century, talk abounded of building private and public colleges in West Texas. Involving themselves in the process were visiting commissioners, turf-conscious legislators, local powerbrokers, competing communities and uncertain townspeople – the same components we see in public debates today. Finally, after a series of events over several decades which are well-chronicled in Homer Dale Wade's "Establishment of Texas Technological College," a decision was reached in 1923 to establish Texas Technological College in Lubbock, Texas.

Amid the 38th Legislature's practical and specific directions about land, money and programs, Texas Senate Bill 103 set forth the following philosophical guidelines, directing that the new school "shall be a co-educational college giving thorough instruction in technology and textile engineering. . . and said college shall also have complete courses in the arts and sciences, physical, social, political, pure and applied, such as are taught in colleges of the first class. . . said college being designated to elevate their ideals, enrich the lives and increase the capacity of the people for democratic self-government."

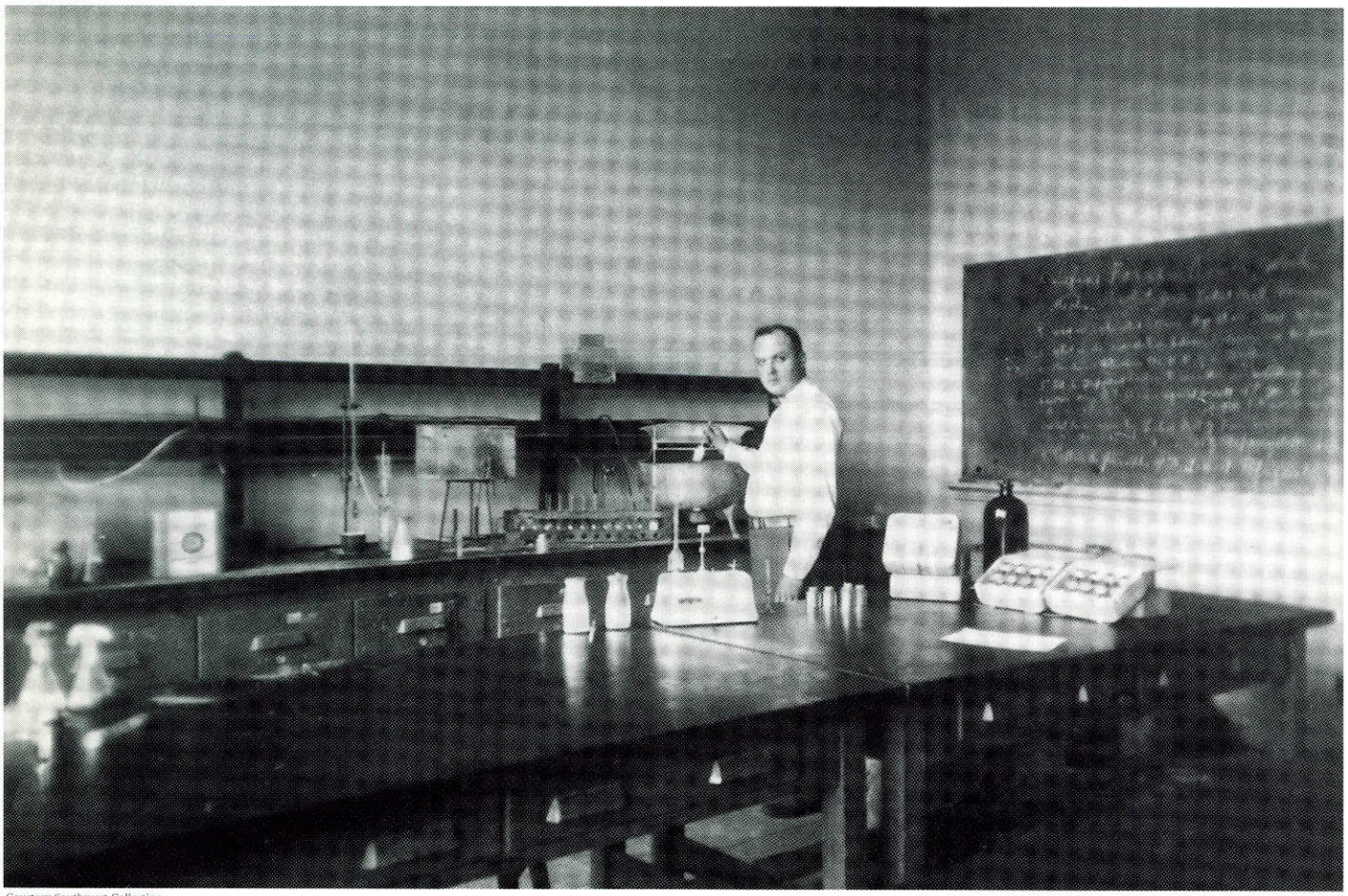
The founders of the college thus envisioned a lofty yet concrete mission for the school they were creating. The local citizens and the first faculty members, students and administrators took great risks by investing their energy and talents in the new college. Probably no one at that time imagined the enormous changes that would affect the world, the nation, the community and the school during the decades to follow, but the first programs were structured with enough essential soundness, flexibility and ambition so that the college could continue and flourish in a changing environment.

I believe that these same elements – a focus on our mission, a willingness to take risks, and the ability to respond to change – can successfully carry Texas Tech University into the 21st century.

When Texas Tech initially opened for the fall 1925 session, 649 men and 276 women had enrolled, making it the fifth largest college in Texas. Anecdotes from the early days provide many insights into the pride of the students and faculty despite doubt from state officials – a situation still familiar to Texas Tech today.

A legislator had even taunted the college president about the lack of need for the new school, saying that if more than 300 people enrolled he would walk from Austin to Lubbock to see them. With more than 900 students in the first enrollment, President Paul Whitfield Horn wired the following message: "Start walking."

Some but not all aspects of life at Texas Tech in 1925 were noticeably different from the experiences of today. The first catalog (January 1926) describes Lubbock as "a rapidly growing little city of approximately 15,000 inhabitants" with 10 passenger trains daily and 18 automobile passenger stage lines. No tuition was charged at the new school, though students had to pay late fees and change of course fees, a clear indication that from the beginning students availed themselves of what we now call late registration and drop-add. A managed health care program assured stu-



Courtesy Southwest Collection

dents that their $1.75 medical fee gave them access to sanitarium facilities, ambulances, medical examinations and minor surgical operations. Students in that first year were encouraged to cultivate their own acre of campus land for crops which they could sell to offset their educational expenses.

A concern for the spiritual dimension is evident in all early publications of the college; the first catalog, for example, describes for students the YMCA, the YWCA and activities of various local churches. Greek-letter fraternities and certain other organizations, however, were banned as violating the democracy of spirit intended for the college.

Among the few student organizations described in the first catalog is the Women's Athletic Association, and the July 1926 catalog prominently features a photograph of the women's basketball team, indicating that the present success of Texas Tech women's sports has early roots. Women's contributions to Texas Tech were by no means limited to athletics, however, for they are specifically mentioned in descriptions of other clubs and organizations.

Moreover, in the area of academics, women students and faculty were part of the university from the beginning. The first catalog, in fact, contains an eloquent and surprisingly modern statement about the coeducational status of the new college: The bill by which the Texas Technological College was established provides that the institution shall be coeducational, a policy which the management of the institution is pleased to make its own. Consequently from the day the doors first opened young women and young men have been admitted on an equal basis and each has proven an inspiration to the other.

Molly Ivins has commented that "Texas was hell on women and horses," and she also reminds us that women in Texas could not vote until 1918, could not serve on a jury until 1954, did not have full property rights until 1969, and until 1972 could be killed by their husbands under a "justifiable homicide" law if found to be unfaithful. Yet, somewhat remarkably, women, at least European-American women, could attend and teach at Texas Tech from the day the school opened in 1925.

The total percentage of women faculty at Texas Tech has ranged from a low of 16 percent in 1950 to a high of 33 percent in 1995, although women accounted for only 23 percent of the tenured and tenure-track faculty in 1995 (the year for which most recent figures are available). In her essay "Women Faculty: Frozen in Time," Martha West points out that "By 1993-94, 31 percent of faculty nationally were women, but the percentage of women among Americans earning doctorates had increased to 47 percent." In other words, approximately

Courtesy Southwest Collection

Members of an early riding club are photographed near the old gymnasium, displaying the Double T. Also seen to the right is the original stadium.

An understanding of present circumstances and an appreciation for future possibilities can be enhanced through the exploration of past events.

half of all American doctorates are now earned by women, but that figure has not necessarily translated into proportional increases in the numbers of women faculty. Outside the College of Human Sciences, the number of women faculty in tenured ranks has historically been relatively small at Texas Tech, and the number of women full professors, even in the humanities, has been even smaller.

In some cases and during some time periods, the presence of women actually diminished over time. In 1926, for example, 40 percent of the tenured/tenure-track faculty in English were women, but in 1995 only 22 percent of the tenured/tenure-track faculty in English were women, although the percentage of women in the department did increase in 1996. Statistical figures speak for themselves as to the numbers of women at Texas Tech, but they do not tell the stories of specific individuals who did or did not move up through the ranks and who did or did not leave the university for positions elsewhere.

Forty-one men and 14 women are listed as faculty in the first (January 1926) Texas Tech catalog. Nine held only bachelor's degrees, 29 held master's degrees and nine held doctorates. In later years, 11 more of the original group did go on to earn doctorates. Some faculty members, though, either had earned no degrees or else their degrees were just not listed in the catalog. It has been reported that President Paul Whitfield Horn was as concerned for active church membership as for academic credentials in selecting the first faculty, but the first faculty members came from fine private and public schools around the nation – Harvard, Yale, MIT, Columbia, Vanderbilt, Chicago, Texas, Ohio State and Michigan, to name a few. Almost three-fourths of the original faculty remained at Texas Tech for their entire careers, a record that reflects a remarkable degree of loyalty.

The most striking development at Texas Tech over the past 70 years has been the growth of the institution at all levels. With some exceptions during the depression, the number of students grew steadily until after World War II, at which point attendance grew rapidly and then skyrocketed in the 1960s. Despite tightened admission requirements over the last five years, more than 24,000 students currently enroll on the main campus during each fall semester. The university presently offers 100 or so master's programs and about 50 doctoral programs, and the university now grants approximately 140 doctoral degrees and approximately 750 master's degrees each year.

With regard to students on campus, Texas Tech, unlike some other schools in the state, has always accepted women, but it has not historically welcomed all people. While international students from many continents studied at Texas Tech even before World War II, African-Americans were not admitted until the 1960s. In 1942, the Board of Directors passed a resolution that "no person of Japanese heritage or ancestry would be permitted to enter Texas Technological College."

Such historical precedents and resolutions as these have long been superseded by affirmative action policies, and people at Texas Tech today realize and affirm that we are enriched by diversity in our students and faculty, a diversity that

includes but is not limited to the representation of various races, ethnicities and nationalities on campus. Still, it is necessary for us to recall our history, even when it is not pretty, and to learn from our past failures as well as our past successes.

Just as the student population has increased, so has the number of administrators. Nine administrators are listed in the 1926 catalog: the President, the Dean of Liberal Arts, the Dean of Agriculture, the Dean of Engineering, the Dean of Home Economics, the Dean of Women, the College Secretary, the Registrar and the Librarian. Three of these, the Dean of Women, the Dean of Home Economics and the Librarian, were women. Throughout the early years, the administration consisted primarily of the president and the academic deans, so the academic function of the institution was always clear in its administrative orientation, and, since the Dean of Home Economics and the Dean of Women were always female, women were represented as members of the top administration.

The ranks of administrative officials, however, have not only grown in numbers but have come to reflect a non-academic or at least non-teaching layer of management. In 1970, for example, the catalog listed 35 "Principal Administrative Officers" (the President and Vice Presidents) followed by pages and pages of "General Administration" for various deans, assistant deans, admissions officers, athletic personnel and so on. After the mid-1970s, the university catalog ceased listing the deans and other administrators.

The 1995 catalog, for instance, named eight "Principal Administrative Officers," none of them women, who included the President, the Executive Vice President and Provost, the Vice President for Administration, the Vice President and General Counsel, the Vice President for Governmental Relations, the Vice President for Institutional Advancement, the Vice President for Fiscal Affairs, and the Vice President for Student Affairs. Of these eight, only three, the President, the Provost, and the Vice President for Student Affairs, held Ph.D.s.

Determining the complete number of administrators and staff members is difficult because of varying definitions of the word administrator, but, obviously, there are more than eight administrators. The new structuring of the university to include a chancellor will create yet more changes in the administrative pattern of the university, the advantages and disadvantages of which cannot yet be fully assessed.

Several issues emerge with regard to faculty growth at Texas Tech. Obviously, the sheer numbers of faculty have grown in proportion to the growth in student numbers and program diversity, but the type of faculty has also changed over time.

Early in the history of the university, emphasis clearly fell on teaching rather than research. Early research efforts, such as the 1930s expedition to Mexico to study the language and lives of the Yaqui Indians, were notable but relatively rare. Fewer than 20 percent of the faculty held doctorates in the early years. Around the time of the second world war, however, research began to receive greater attention, and a greater proportion of tenured and tenure-track faculty came to hold doctoral degrees; now virtually all tenure-line faculty have earned doctorates and conduct original research.

This development has resulted from the expansion of the graduate school, which was established in 1935, from general maturation and growth within the university, and from national trends in education. The debate over faculty responsibilities continues today not just at Texas Tech but across the nation, well-documented by published discussions about the differing and sometimes competing demands of teaching and research and about the appropriate use of non-tenure track, part-time, graduate student or adjunct instructors.

Tensions also have existed at Texas Tech, as in other places, regarding management and governance. People with strong points of view within the local community have sometimes felt that the university ought to answer to them. In present times, controversial speakers in a lecture series or controversial theater productions have served as starting points for such debates, but community interest was perhaps stronger in previous eras.

In the middle of the 1930s, 16 professors were fired after a storm of public protest erupted across the state against Texas Tech teachers involved in "atheism and infidelity." Some of these charges grew out of the region's generally conservative environment, while others were related to the political and economic turmoil associated with the depression. One of the fired faculty members, for example, was Dr. Thor Beck, a language professor who had visited Russia and subsequently spoken favorably of the Five-Year Plan. The Board of Directors claimed that these professors were not fired, but that, rather, their contracts were not being renewed because of economic contingencies. In this case, as in later ones, though, pressures grew out of administrative and academic tensions as well as community tensions.

The 1950s case of Byron Abernathy also exemplifies diverse and complex pressures. Though he was a full professor with 16 years of service to the university, Abernathy's contract was not renewed by the Board of Directors, and the situation resulted in a 10-year censure by the American Association of University Professors; because of this episode, defending academic freedom has been a primary goal of many Texas Tech faculty ever since. Again in the mid-1980s, another governance controversy erupted over tenure, and the faculty gave a no-confidence vote to the president.

Underlying all such conflicts is the question of who holds authority in various kinds of controversial situations – the faculty, the campus administration, the board of regents, the local community, state officials or the tuition-paying students and their families. With regard to governance issues, regardless of whether they are plain and simple or subtle and multifaceted, Texas Tech would do well to heed the lessons from its past.

A review of the Linguistic Society of America's 1995 Directory of

Programs shows that the evolution of Texas Tech University's linguistics program bears many similarities to the growth of language studies in other universities. Changes and developments in this program and in others no doubt take on a different perspective when viewed through a retrospective lens, for change is often difficult to detect and hard to understand at the time that it occurs.

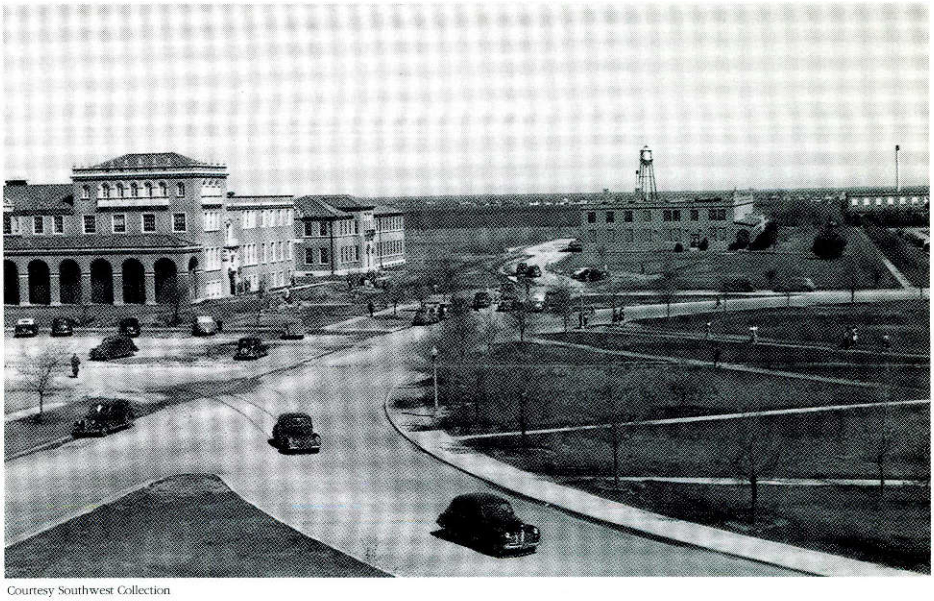
Two key lessons from historical linguistics might apply to our understanding of language programs and of non-linguistic matters throughout the university. First, change is natural and inevitable. Languages that do not change become stagnant and die. So, too, do programs and departments and universities. Second, despite its roots in the past and its influences on the future, change always happens in the present. Any kind of change, whether in language or in a university, is more easily recognized and understood from some historical distance, but those who can understand their present circumstances may have a better chance to affect their outcomes.

Writing in The Chronicle of Higher Education about the difficulties that lie ahead for academic medicine, Steven Schroeder recalled a story of two hikers accosted by a grizzly bear. When one hiker quickly prepared to flee, the other protested that attempting to outrun the bear was futile, but the first hiker replied, "I don't have to outrun the grizzly. I just have to outrun you."

As Texas Tech University competes with other universities for students and with other agencies for funding, a danger exists that we will not only try to outrun the competition but that we will turn our fears inward and begin to look suspiciously at other departments and other colleges on campus, and perhaps even at other colleagues within our own colleges and departments. While we should strive for continuous improvement, our motive should not be to sacrifice any of our fellow hikers, particularly those in our own hiking party.

If we abandon such a paradigm as dishonoring and degrading to us as well as to our competitors, we have to find some other way to manage our assorted and mighty present-day risks. Hunkering down in the hope that the grizzlies will go away does not seem to be a viable alternative. If we look to the past, to the heritage of Texas Tech University's fascinating but not unblemished history, we can discover another set of possibilities that apply on the individual level as well as on the university-wide level: accept the risks, take the challenges, and plan with boldness, openness and creativity for the future.

An understanding of present circumstances and an appreciation for future possibilities can be enhanced through the exploration of past events. In the departments with which I am familiar, many present attitudes and behaviors have grown out of policies and events from the past, and a ripple effect can keep active dynamics even from long ago. It is worthwhile for us to gather and learn historical information about our departments and colleges as we establish goals for the future. While each unit of Texas Tech has its own history, its own specific mission, and its own environment, planning for the future is essential, especially given the present economic and political environment in which every program is under scrutiny, downsizing is common, and professional demands increase.



Courtesy Southwest Collection

Texas Tech eventually grew to include the Science Quadrangle, Memorial Circle and the Engineering Key.

One lesson from the history of Texas Tech shows that the university was founded with much ambition and enthusiasm, but that courses and programs have risen or fallen, sometimes without much foresight, and that individual faculty members have come and gone, bringing and then taking programs and plans that may never have been fully evaluated or fully appreciated for their relevance to the larger goals of the institution.

An analysis of our history shows that we need to take a long view of where we would like to see our programs, not just this year, or the next fiscal year, but in five years or 10 years or maybe even 50 years. Change is inevitable and risk is unavoidable, but our essential mission as established by Senate Bill 103 can remain stable as we move into the 21st century. □

(Editor's Note: Mary Jane Hurst, an associate professor of English, also teaches in Honors, Women's Studies and Interdisciplinary Linguistics. The author of "The Voice of the Child in American Literature" (UP of Kentucky, 1990) and many articles about language, she currently is working on a study of gender and language in contemporary fiction.)

Inside Back Cover – Standing in the cathedral-like Holden Reading Room of the Southwest Collection/Special Collections Library is newly appointed Associate Director William E. Tydeman, Ph.D. Before becoming director, he served as historian for the Bureau of Land Management in Boise, Idaho. His research concerns the cultural history of the American West. As homage to the university's heritage, the original wrought-iron gates in Texas Tech's first library have been incorporated into the reading room, named in honor of William Curry and Frances Mayhugh Holden. (Photo by Artie Limmer)

Back Cover – The new Southwest Collection/Special Collections Library at Texas Tech University, which opened this spring, is situated between the University Library and the Agricultural Pavilion. With almost 78,000 square feet of floor space, the new building houses documents, photographs, maps, newspapers, films, books, oral history tapes and periodicals. Also, the facility includes the Archive of the Vietnam Conflict and the Rare Books Collection. The climate-controlled environment will protect materials from temperature and humidity problems that could damage valuable documents. (Photo by Joey Hernandez)

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