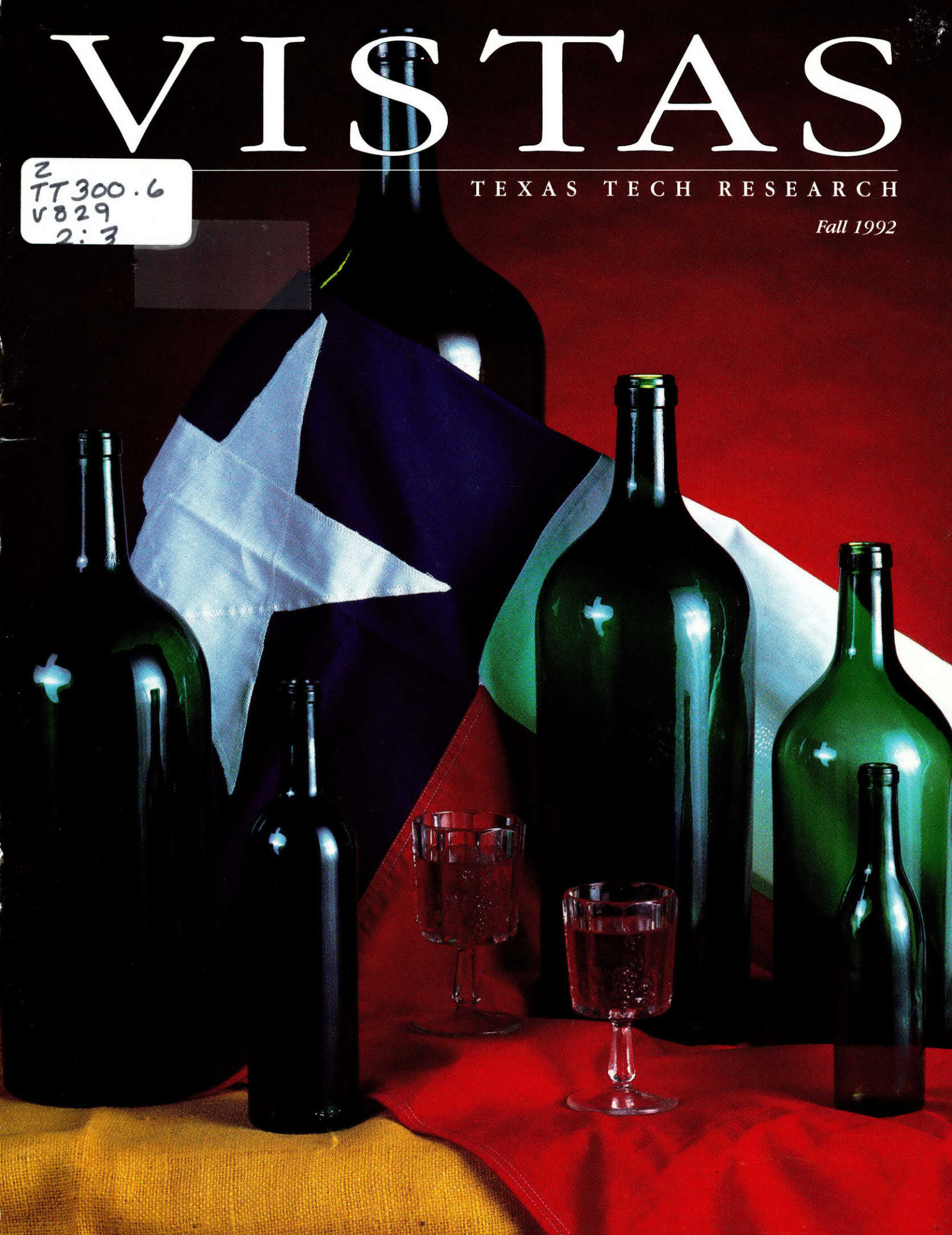


VISTAS

TEXAS TECH RESEARCH

Fall 1992

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VISTAS

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Vol. 2 No. 3

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 at Texas Tech University Health Sciences Center.

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ABOUT THE COVERS

Front—Lone Star vintagers are endeavoring to market Texas-produced wines throughout the United States and abroad. The first challenge is to convince Texans that the homegrown product is a respectable one. Researchers at Texas Tech University are helping to ripen the industry beyond its infancy through marketing, winemaking and grape-growing. (Photo by Mark Mamawal)

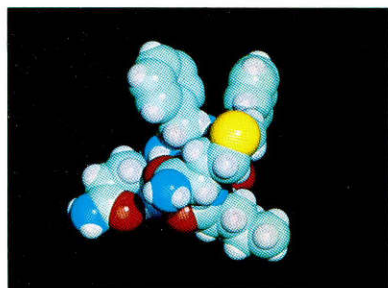
Back—Texas Tech senior Ross Davis is on his way to the Paralympics in Barcelona, Spain, where he will defend his world records in racing. He earned national stature in the 100-meter and 1500-meter races in New York during Paralympic trials. Four years of racing has prepared him to contend in the 100-meter, 200-meter, 400-meter and 800-meter races. Davis, a therapeutic recreation major in the exercise and sport sciences program, will be staying with the United States team in the Olympic Village. (Photo by Artie Limmer)

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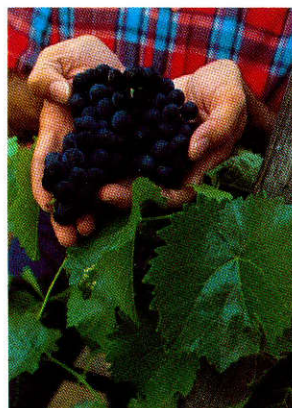
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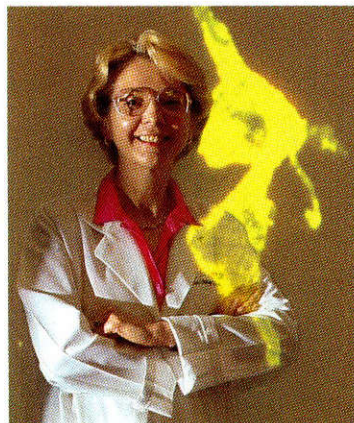
Page 2



Page 19



Page 10



Page 22

OBSERVATIONS

A Glance at Research and Creativity

International Excavators; Crossing Generational Gaps; Cotton and Oil-Spill Cleanups; Stress and Reproduction; A Martian Fingerprint; Olympian Courses; Whole Language Literacy

2

VIEWPOINT

Ethics and Taxation, by Jane O. Burns, Ph.D.

A professor of accounting examines the public responsibilities of CPA professionals.

8

COVER STORY

Lone Star Vintagers Concoct Texas Tastes, by Kippra D. Hopper

Researchers are finding room for growth in the grape growing and wine making industries of the state.

10

FEATURES

Literature and Politics in Spain, by Myrna Whitehead

A researcher links the political and philosophical contexts of a nation to its literature and language.

17

The Eyes: Gateway to the Body, by Jim Barlow

Scientists who are working together to solve problems of the eyes are helping to heal other ills.

19

The Slow Dimming of the Mind, by Preston Lewis

Alzheimer's disease takes over the mental capacities of millions, challenging healthcare workers to deal with the results.

22

Caregivers Find Solace, by Catherine Dunn

Families are unprepared to assume caregiver roles.

25

Pork Production Gaining Weight, by C. Louis Bischoff

Institute is assisting the pork industry in competing with beef and poultry producers.

26

Consumer Complaints Wanted, by Jennifer LeNoir

Marketing researcher investigates customer satisfaction and complaint behavior.

29

PERSPECTIVES

The Burden of Mathematics Anxiety, by Nina L. Ronshausen, Ed.D.

Apprehension about numbers, a universal experience, most often strikes young girls.

31

A Glance at Research and Creativity

International Excavators

As the early morning West Texas sun gains intensity and the din of near-by rush hour traffic begins, an international team of 35 student archaeologists begins another day of painstaking excavation work at Lubbock Lake Landmark.

The 300-acre archaeological site lies hidden in a wooded valley bordered by soccer fields to the northeast and Loop 289 to the southeast. Its vast archaeological record about the history of pre-historic people is a virtually untapped resource.

Along with American students, the excavation teams are comprised of international students from countries such as Italy, Germany, Taiwan, England, Canada, Costa Rica and Australia. Receiving only room and board as wages, workers put in five-day 45-hour work weeks between mid-May and late-August.

The students gain intensive hands-on experience and have the opportunity to work under the direction of Eileen Johnson, Ph.D., the landmark's world-renowned director. Johnson, the anthropology curator at the Museum of Texas Tech University and a scientist of the Quaternary period, studies the Earth's last 2 million years with an emphasis on human-made artifacts.

This year, a pilot project offered four students from the National Taiwan University an opportunity to learn the highly specialized excavation techniques used at the landmark, said Mei Campbell, a native of Taiwan and anthropology collections manager at the Museum of Texas Tech. The specialized

techniques involve using fine-mesh screens in washing all soil from an excavation unit to recover micromaterials. This procedure is still fairly uncommon in the United States, Johnson said.

The summer's work is concentrated at two sites. One archaeological team has launched a stabilization effort intended to slow the erosion of the embankments created by the Works Projects Administration in the 1930s. The WPA dredged the area that had dried up in an attempt to reactivate natural springs. The project was unsuccessful and unearthed or destroyed part of the buried archaeological record.

What remains resembles a doughnut — a circular pattern with an island of undisturbed dirt. When the dirt was moved, the artifacts and skeletal remains it contained were then exposed and have been subjected to erosion for nearly 50 years.

The field staff has mapped the embankments and has collected all artifacts that protruded or had fallen. The embankments will be covered with plastic, sand bags and plywood to halt erosion until future excavation work can be completed.

A second field staff reopened a site that has been periodically excavated since 1988 and contains at least two significant layers of sediment. The uppermost layer is what remains of a marsh, dating to the 1700s. Preserved in this layer are hoof prints from the bison that came to drink water and some animal skeletal remains trampled on as the bison waded through the marsh.



Photo by Artie Limmer

Approximately one and a half feet deeper into the ground is a layer of jumbled, densely packed bison bones that archaeologists speculate represent an animal carcass butchering ground. The area containing these two layers was discovered in 1987 when test trenches were dug to determine if any significant artifacts were buried there.

The butchering site's significance lies in its size — estimated at an acre — the concentration of bones it contains and the time periods represented by the bones. The site will help researchers understand the region's level of cultural activity and the types of climatic changes, Johnson said.

The 300-acre site is now a state and national landmark and is listed on the Register of Historic Places. It is one of the largest known complexes in the New World for tracking hunter-gatherer or semi-nomadic, subsistence cultures. The site offers scientists one of the most complete records of Southern Plains cultural sequences from the Clovis period approximately

Archaeologists search for evidence of human occupation while school children tour the Lubbock Lake Landmark.

11,500 years ago to the Modern period. The Modern period includes artifacts recovered from the Singer Store, Lubbock's first business.

Working with Johnson, research assistants Nicky Ladkin and Elizabeth Miller have pioneered an archaeological study of burned caliche and its relation to cultural activity.

"Caliche has been analyzed in geology, but in archaeology it has usually been disregarded," said Ladkin.

Currently, Ladkin and Miller are working to publish their findings. They agree that the caliche research has a broad application in the archaeology of the High Plains, an area extending from Lubbock northward to the Dakotas. "I think publication is very critical. If you have the responsibility for taking it out of the ground, then you have an equal responsibility to publish that information," Ladkin said.

— C. Louis Bischoff

Crossing Generational Gaps

After the death of her grandmother six years ago, 18-year-old Lucie Rodriguez felt a void in her life.

Charlie and Iva Pierce have teen age grandchildren, but they lack day-to-day interaction with persons in their teens. Through the Youth Exchanging with Seniors project (YES), Lucie has "adopted" a set of grandparents, and the Pierces now have the daily interaction with a teen who keeps them in contact with the outside world. Bringing senior clients and teen care-givers together is how the Texas Tech YES project is helping to bridge the generation gap.

The YES project has gained national recognition by winning prestigious awards from President George Bush's Points of Light Foundation and from Generations United, an association of more than 100 groups interested in rural and urban youth activities and senior issues.

YES is jointly sponsored by the Texas Tech University College of Home Economics, the School of Medicine and the Texas Agricultural Extension Service. The project aims to enhance the independence of rural senior citizens and to promote positive intergenerational relationships.

Volunteer youth group members work with senior clients in 20 South Plains counties to provide assistance, for example, with housekeeping, lawn and garden work, minor home repairs, auto maintenance

and personal care including help in preparing bill payments, reading the newspaper or shopping for groceries.

The services are directed toward what co-director Betty Stout, Ph.D., calls the other side of aging, those senior citizens who are not in nursing homes and are trying to remain independent. Stout is an associate professor of home economics education.

In May, President Bush's Points of Light Foundation designated the YES project as the 775th Point of Light. According to the foundation, the project was chosen because it successfully addresses one of the country's most pressing social problems through direct and consequential acts of community service.

Also in May, Generations United chose the YES project as one of five programs to receive its Pioneer Award. Generations United is an association of groups such as the Children's Defense Fund, the National Council on Aging and the American Association of Retired Persons. Award recipients are chosen for their exemplary intergenerational initiatives.

Other YES project co-directors are Sheryl Boyd, Ed.D., assistant chairperson for development in the department of internal medicine at Texas Tech University Health Sciences Center, and Kathy Volanty, District 2 director of the Texas Agricultural Extension Service.

"The interaction between active seniors and YES volunteers adds a bright spot to an elderly citizen's often solitary existence," Boyd said. "When we're talking about being a well person and aging issues,

we need to look at all the components: mind, body and spirit.

"YES unites youth and seniors in mutually beneficial service and learning activities. Working intergenerationally, YES partners share life experiences, build self-esteem and foster the spirit of volunteerism to respond to rural social and humanistic needs," she said.

Phase one of the YES pilot project, which ended in January, received funding from the Robert Wood Johnson Foundation of Princeton, N.J. The initial funding allowed the YES project to involve home economics teachers, extension agents, members of the Future Homemakers of America and 4-H groups to test a project model.

One of the goals of the pilot phase was to design and package YES as a self-contained project, allowing almost any organization, even

with a limited budget, to implement the project, Volanty said.

"We now have developed supporting materials for YES which include a three-part video series, a YES Project Leader's Guide and a Youth Service Provider Guide," she said.

The three-part video series contained in the YES package received awards in the education categories of two national video production competitions, the Telly Awards in February and the Retirement Research Foundation's Wise Old Owl Award in April.

Last year, Texas Future Homemakers of America adopted YES as a statewide project and this year have continued its involvement. The Texas Rural Electric Women's Association has adopted the YES project as its statewide program for 1992.

— C. Louis Bischoff



The YES project joins senior clients and teen care-givers in mutually beneficial relationships.

Photo by Mark Mammal

Cotton and Oil-Spill Cleanups

Thousands of barrels of murky crude continue to spill into Aransas Bay from a sinking barge. However, the nearby winter home of the endangered whooping crane may be saved by West Texas cotton.

Say what? That scenario is possible if Texas Tech University researchers in chemical engineering and biological sciences have their way. Under a \$400,000 contract with the Texas General Land Office, the researchers have until March 1993 to determine if West Texas' top agricultural product can effectively adsorb shallow water oil spills and then be destroyed biologically.

If the method works, it could become a less expensive alternative to a system that now results in heavy oil-soaked polypropylene pads or socks being incinerated and/or disposed of in landfills, creating environmental problems in both the air and the ground.

"The idea is to get the oil out of the environment before it impacts any of the fragile coastal ecosystems. And then the question is: What do you do with the oil-soaked cotton once you have it removed from the water?" said Caryl Heintz, Ph.D., a professor of biological sciences who has worked extensively in environmental and applied problems in microbiology, including oil-degrading bacteria in the early 1970s.

"What we're trying to determine is whether you can degrade both the cotton and the oil biologically," she said. "Hopefully, the by-products are going to be carbon dioxide, water and microbial

cells, which you dispose of rather readily without causing any more contamination."

Texas Tech's research will use raw low-grade West Texas cotton because of its virtually unlimited availability. "Scoured and bleached cotton is preferentially wet by water. It's a very poor adsorbent for oil," said Harry W. Parker, Ph.D., a professor of chemical engineering. "But raw cotton, as it comes from the field or from the bale, has enough waxes so that it is selectively wet by oil."

Researchers may add surfactants, such as gelling agents or fertilizers, to improve the cotton's ability to contain the oil and facilitate biodegradation.

Parker knows oil. He holds 82 patents for oil recovery methods. For 13 years, he was a research group leader and theoretical development engineer for Phillips Petroleum Co. He earned his bachelor's degree in chemical engineering in 1953 from Texas Tech, then received his master's and doctoral degrees in chemical engineering in

1954 and 1956, respectively, from Northwestern University.

Parker joined the Texas Tech faculty in 1970, although he was granted leave during 1979-81 while he was an engineer-in-residence of the Engineering Societies Commission on Energy in Washington, D.C.

Texas Tech is the only university investigating adsorption under the General Land Office's new \$1.25 million annual research and development program, which was prompted by the state Legislature's Oil Spill Prevention and Response Act of 1991. Several other institutions are looking at different aspects of oil-spill cleanup efforts.

This summer, researchers designed a wave tank, measuring 12 feet long, 4 feet wide and 4 feet deep, and a 250-gallon capacity bioreactor at the Research Center-East Campus.

In the wave tank, tests will determine how best to use the raw cotton and how its use compares with pads and socks made out of commercially used polypropylene

and other synthetics, other cotton material and wool. Also to be considered is the tendency of spilled oil to circumvent a sorbent boom, or a floating barrier used to contain the spill.

After the oil-soaked cotton is removed from the wave tank, the biologists will take over, hoping to break down the cotton fibers and the oil in the bioreactor. "We know there are certain organisms to get rid of the cotton. That's the easy part," Heintz said. "There are other organisms that can get rid of the oil. Our job is to get rid of both, either sequentially or simultaneously, using bacteria or fungi or other biological means.

"We're looking at a commercially available consortia of organisms and some of our own off-the-shelf combinations. From prior research in Texas Tech's civil engineering department, we had found that often we have to have combinations of organisms. This gives us a synergy that has more of an additive effect than the use of a



Using a gyratory shaker, Caryl Heintz (left) and Harry Parker test various surfactants with oil and cotton.

Photo by Mark Mennard

sequence of organisms," Heintz said.

In addition to the east-campus facility, the project will use laboratory space in the Biology, Civil Engineering and Petroleum Engineering buildings. Helping Parker and Heintz are Phil Nash, research associate for the Center for Advanced Research and Engineering; Clifford B. Fedler, Ph.D., associate professor of civil engineering; two post-doctoral research

associates, Malyng Lu in chemical engineering and Deborah L. Carr in biological sciences; three graduate students; and six undergraduates.

At stake, according to the General Land Office, is the protection of the habitats of fish, fowl and mammals in the wetlands, bays and estuaries along the 367-mile Texas coastline. Such protection also can preserve the annual coastal infusion into the state's economy, such as sea-

food harvests totaling \$250 million, \$3 billion in tourism and the shipping industry, which in 1989 saw \$23.6 billion worth of cargo transported on the Intracoastal Waterway. The same region also is home to one-fourth of the nation's refining capacity and 65 percent of its petrochemical production.

The various research projects being done under the General Land Office's program can help the state's reg-

ulators, Parker says. "A big part of the responsibility of university research is to be sure that the things that are said and done have a sound scientific and engineering basis so the regulators can make rational judgments about proposed cleanup methods."

As for West Texas cotton producers, another market could be blossoming.

— Jim Barlow

Stress and Reproduction

A couple, assumed infertile, finally gives up on conceiving a child and adopts a baby. No sooner does that happen than the woman becomes pregnant.

A medical explanation always has been hard to pinpoint in such cases, but a reproductive biologist at the Texas Tech University Health Sciences Center suspects that the answer may be stress.

Using Rhesus monkeys, Reid L. Norman, Ph.D., has shown a marked decrease in the hormones necessary for fertility among both males and females when the animals are subjected to even moderate stress.

"Stress may well be one of those things which impairs fertility," Norman said, "but the pathology is not as apparent as it is with low fertility for other reasons, such as a blocked fallopian tube or low sperm count."

Norman, a professor of cell biology and anatomy, is trying to understand that pathology or change brought about by stress on the reproductive system. He uses Rhesus monkeys because of their similarity to the human reproductive

system. Female Rhesus monkeys have a reproductive cycle similar to women and male Rhesus monkeys secrete sex hormones in much the same way as men.

Before each experiment, the subject Rhesus is given a small dose of anesthetic which temporarily sedates the animal. It is then removed from its cage and placed in a special chair which restrains the animal but allows it to move its arms and legs.

Norman likens the restraint and the resulting stress level to that which a human would feel when caught in a traffic jam. There might not be any outward signs of stress, but the body is reacting physiologically to the frustration.

Using a catheter, Norman samples minute amounts of blood during the course of the animal's restraint. Blood analysis has shown elevated levels of cortisol and adrenocorticotrophic hormone, or ATCH, which is expected under stress. What was unexpected was the immediate reduction in gonadotropins, the hormones which stimulate the gonads in males and

females, and decreased levels of the male hormone testosterone.

"This persists not only during the period of stress," Norman said, "but also for a number of hours afterward. Though we haven't followed this out chronically, if someone were under continual stress on the job or in the family over a long period of time, it could and probably does result in reduced fertility for males and females because it is a repeated interruption of the stimulus to the gonads."

The stress, for instance, of failing at conceiving a child could make a husband or wife infertile. Once the couple adopts a child, however, the stress is eliminated and the husband or wife become fertile again. Both they and their doctor are surprised when they conceive a child.

"We chose a psychological stress rather than a physical stress," Norman said, "because the psychological stresses are a much more potent activator of the physiological system we call the hypothalamic-pituitary-adrenal axis."

This physiological system is responsible for shutting down the body's various systems whenever the body is faced with a "threat" to its normal operation. These threats can range from an injury to hunger to psychological stress.

"It is not in the best interest of an individual to reproduce at times when the environment is unfavorable," Norman said. "As a result, the hypothalamic-pituitary-adrenal system responds to physiological stress by shutting down systems unnecessary to individual survival."

Norman's research focuses on the most potent sex organ — the brain — to understand its biochemical influences on reproduction. By delineating these influences and their long-term implications on the reproduction system, the research could point the way toward new treatments for infertility.

And, new treatments could ultimately take the anxiety and stress out of trying to become pregnant for some couples.

— Preston Lewis

A Martian Fingerprint

Do planets have their own unique fingerprints that make them unmistakably identifiable? Texas Tech University's Haraldur R. Karlsson, Ph.D., may have come up with a geologic fingerprint that differentiates Earth and Mars.

While a National Research Council postdoctoral fellow at the Johnson Space Center, Karlsson used a high-temperature vacuum process to extract a water droplet measuring 1/64th of an inch — enough to excite NASA and planetary scientists — from each of six meteorites previously identified as Martian in origin.

A study of the water's oxygen isotopic composition confirmed the water was not Earth's. The analysis also found that the water was not in isotopic equilibrium with the host rocks, which, Karlsson says, may have profound implications on the origin and evolution of the Martian hydrosphere.

"Karlsson's work shows that you may be able to use the measurement of oxygen isotopes as a fingerprint of planetary bodies," said Robert N. Clayton, a professor of geosciences and chemistry at the University of Chicago's Enrico Fermi Institute. "With the assumption that the meteorites were Martian, his analysis allows us to recognize the distinction of Mars and the Earth."

The lack of isotopic equilibrium, Karlsson says, means that the Martian atmosphere has divorced itself from the crust. "There is no interaction. This was the big surprise. The reason may be that

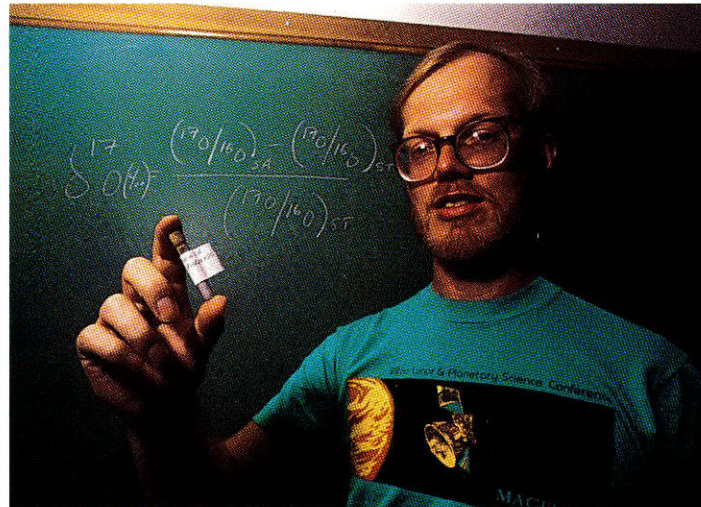


Photo by Mark Mamawal

there is no plate tectonics on Mars."

Karlsson's find also heightens the interest on the origin of atmospheres and raises one very basic question: What happened to the surface water on Mars?

Mars today is devoid of surface water. Its atmosphere contains only minute traces of water vapor. Yet photographs taken by NASA's Viking spacecraft and Mariner 9 suggest that Earth's neighbor once had a water-rich atmosphere, flowing streams, water-carved tunnels and perhaps oceans. So where's the water? "No one knows. It still may be there buried deep in the soils," Clayton said. Karlsson agrees: "Perhaps it's just frozen in the ground as permafrost."

Karlsson, an Iceland native who worked under Clayton as a doctoral student, joined the Texas Tech department of geosciences last fall. This June, he and Clayton began a study of the carbon dioxide of the same meteorite samples. Carbon dioxide is one of the most important constituents of the Martian atmosphere, according to cursory remote sensing of Viking and

Hal Karlsson shows a sample of a Martian meteorite.

Mariner 9. The study may provide more insight about the Martian atmosphere.

Karlsson's initial findings were published in the March 13 issue of *Science*, a scholarly journal of the American Association for the Advancement of Science. Karlsson collaborated with Clayton and Toshiko K. Mayeda of the University of Chicago and Everett Gibson of the Planetary Sciences Branch in the Johnson Space Center's Solar System Exploration Division.

The separation of crust and atmosphere on Mars suggests the planet's surface water may have simply sat on the surface, undisturbed by any regeneration mechanism, Clayton said. Earth's crust intermingles and regenerates itself with the hydrosphere and atmosphere through the deep-sea heating of plate tectonics.

"Even if the oxygen of the rocks, hydrosphere and atmosphere had started out being different in the past, the mixing of plate tectonics would ensure that this differ-

ence was erased," Karlsson said. "Without the recycling process, the possibility arises that there is no interaction between the oxygen atoms in the rocks and those in the hydrosphere and atmosphere."

Scientists have assumed that a study of a planet's atmosphere can give information about the rocks on the surface. "Our work says that now we have to be very cautious," Clayton says. A big question seeping from Karlsson's Martian meteorites is: From where do atmospheres originate?

"The premise is that the terrestrial planets, Mercury, Venus, Earth and Mars, all started out with similar atmospheres," Karlsson said. "Yet today, Mercury has no atmosphere. Venus is shrouded in a thick, hot atmosphere, and Mars has a thin cold atmosphere. Both the Venusian and Martian atmospheres are composed mainly of carbon dioxide. Our atmosphere consists of nitrogen and oxygen. What happened on Mars and Venus?"

For Mars, Karlsson sees three possibilities. The early atmosphere and surface evolved separately, allowing for isotopically distinct reservoirs that have remained decoupled over time. The atmosphere may have formed after the planet grew, when gases such as oxygen trapped in the planet's interior leaked to the surface, in which case the oxygen in the atmosphere and crust may have been in equilibrium initially. Or, the early atmosphere's composition changed as isotopically distinct oxygen was added by the bombardment of comets.

— Jim Barlow

Olympian Courses

While 16-year-old gymnast Kim Zmeskal placed 10th in the 1992 Summer Olympics in Barcelona, she did not let her academic studies suffer. The Houston native's heavy training schedule for the summer games did not allow her time for regular high school attendance so she took advantage of the high school correspondence program offered by Texas Tech University's Division of Continuing Education.

Zmeskal was considered to be the favorite for a gymnastics gold medal in the Summer Olympics. She has been training in Houston with champion trainer Bella Karolyi since she was 6 years old. The nine years of hard training have brought several achievements.

Zmeskal became the first American gymnast, male or female, to win the individual all-around crown at the world championships in 1991. She also was named the 1991 United States Olympic Committee Sports Woman of the Year, and a few months ago, she won the gold in McDonald's American Cup in Florida.

Zmeskal recently completed her first semester of sophomore English and history. Two semesters of each subject must be completed to equal one year of high school credit in each area.

Zmeskal said she was referred to Texas Tech correspondence courses by administrators at Northland Christian School, the private school she previously was attending.

For Zmeskal and more

than 17,000 students, Texas Tech is a source of high school education through its correspondence program.

Suzanne Logan, associate director of continuing education, said Texas Tech has offered the high school correspondence program since 1927. Today, the Division of Continuing Education offers more than 85 high school courses in its program.

"Students are able to register for a course at anytime, 365 days of the year. And they have nine months to complete the course," Logan said.

The high school students complete their lessons at home and mail them to Texas Tech for grading. The students take their final exams either on the Texas Tech campus or at their own high school under the supervision of a certified teacher.

Judy Miller, Texas Tech high school English coordinator in the Division of Continuing Education and Zmeskal's correspondence English teacher, said Zmeskal is a very good student and has made an "A" on each lesson she has turned in.

Zmeskal had planned to return to classroom public school after the 1992 Summer Olympics in Barcelona.

Having attended school both traditionally and by correspondence, Zmeskal knows the pros and cons of each. However, she said, quality of education is not compromised by correspondence courses.

"I also think I'm getting an idea of what college is like. Nobody is looking over my shoulder and telling me what to do. I have to be my own source of motivation," Zmeskal said.

— Dawn Travis

Whole Language Literacy

For educators, current research and practice suggest that reading and English/language arts are inter-related and should be taught together. Some experts believe literacy can be achieved most naturally and rapidly through the whole-language approach — a movement to put literature back into the elementary school and replace the traditional basal textbook approach to teaching reading.

In addition, Texas' education system seeks to avoid bias toward its minority students who often produce low test scores on language and literacy assessment examinations. Traditional teaching methods that fail to reach minority students must be scrutinized, explains Shirley Koeller, Ph.D., assistant professor of education. Armed with the education philosophy of whole-language literacy, Texas will help each student, whatever his or her background, succeed in school by taking its cue from the child.

For the past two years, a team of researchers in Texas Tech University's College of Education have been working to implement a new education curriculum and instruction program, Language Literacy Education. The new program would offer advanced degrees in the quest to replace old theories with new concepts and emerging theories on literacy education. The goal of the program would be to offer shared knowledge among faculty members and graduate students about language and literacy development in kindergarten through 12th

grade.

Under the current education curriculum at Texas Tech, graduate students enroll in separate courses that focus on reading, oral language, literature, teaching, research and practice. In the new program, these separate domains would be housed under an interdisciplinary umbrella to enrich the understanding of language and literacy education.

"We want to explore the theoretical frameworks of language/literacy acquisition and development by understanding how speaking, listening, reading, writing and thinking are interrelated and maximally developed," Koeller said. "We're looking at how people acquire, understand and use language and literacy as well as how social, cultural, ethnic, linguistic and economic environments influence language and literacy learning."

Currently, graduate students can pursue advanced degrees with a specialization in language/literacy because no formal degree exists within the program. If a degree program is implemented, the team is developing a core curriculum which will combine courses throughout the college.

"We recognize that children learn in many different ways and we want to maximize their learning success. The program's long-term goal is not just teaching children how to read and write, but teaching children to experience the joy, purpose and value of reading and writing," said Carolyn Miller, Ph.D., assistant professor.

— Myrna Whitehead

(Editor's Note: The following opinion piece was written by Jane O. Burns, Ph.D., who is a professor of accounting and holds the Frank M. Burke Chair in Taxation in Texas Tech University's College of Business Administration.)

By Jane O. Burns, Ph.D.

Ethics and Taxation

Today's Certified Public Accountants (CPAs) bear a much greater public responsibility burden than they ever anticipated. The list of professional conduct rules no longer protects CPAs from charges of professional or ethical misconduct. The tradition of CPA self-regulation is being challenged. To respond to this challenge, CPAs are turning to self-examination.

Professional codes and statements are being revised. But, more importantly, CPAs are addressing concerns about a possible decline in ethical behavior within their profession.

CPAs in taxation are generally subject to four sets of rules on ethical behavior. Both the state in which the CPA is licensed and the American Institute of CPAs (AICPA) have codes or laws governing a member's professional conduct.

These codes range from broad concepts about a CPA's responsibility to act in the public's interest to detailed statements prohibiting disclosure of client information. The AICPA provides additional guidelines that are designed specifically for members who deal with taxation issues ("Statements on Responsibilities in Tax Practice").

These guidelines cover numerous topics, including those directly related to tax research, the preparation of tax returns and advice to clients on tax matters. Finally, the CPA must comply with government rules when practicing before the Internal Revenue Service and is subject to penalties when Internal Revenue Code sections dealing with tax return preparation are violated.

Historically, CPAs have operated within a rather rigid system of professional standards. This approach is appealing because, in this type of situation, the CPA is viewed as being ethical as long as the standards are followed. There is little ambiguity.

But, times have changed. As society, the courts and the economy have changed, so have the rules of professional conduct. One of the first rules liberalized was the ban on soliciting another CPA's clients. Open competition is now condoned. Meanwhile, the courts are forcing CPAs to accept even greater responsibility for their clients' actions. More and more, the CPA is being asked to "police" the business world.

Committees on ethics and professionalism have been established by the AICPA and the American Accounting Association (AAA), the leading accounting organizations for practitioners and academicians. These committees have sought to focus greater attention on thinking about ethical issues among accounting practitioners, academicians and students.

Historically, the focus has been on "the rule outward" or an individual's reaction to pressures that could result in the violation of a specific rule. Now, we must go beyond the printed professional standards and examine potential



Photo by Arnie Limmer

ethical issues in new ways.

In my classes and through participation on the Ethics Research Panel of Experts for the AAA, I have developed numerous accounting case studies involving ethics, which are used in my classroom and those of my colleagues around the country. These cases focus on potential ethical issues that do not violate any printed rule or law. They have no one answer but are designed to stimulate thought and debate. For example, when a new client brings in an old tax return with an error, CPAs are not bound by any rule to require the client to correct the error. But, there may be an ethical duty to do so.

Accounting students and CPAs need to think about these issues and discuss them. This process places an emphasis on questioning legally acceptable actions that may not feel right. These are sometimes difficult decisions, especially in a profession that is operating within a self-reporting system.

The CPAs' changing role may be partly attributed to the fluctuating economy, which is forcing CPA firms to operate more like other competitive businesses. An example of this is how accounting firms have traditionally established fees and billing policies. Previously, most firms billed clients by the hour for their services, now there is a trend toward assessing a charge for specific services, which is more market driven.

Many accountants are very uncomfortable with this approach to billing and to competitive bidding. While this procedure may appear more equitable to some clients, the down side is that CPAs no longer have the luxury of thoroughly investigating a problem and perhaps coming up with a more creative solution that may actually benefit the client more in the long run.

Unfortunately, few proactive approaches that emphasize ethical decision making within the accounting profession have been developed. And, despite increased interest, few empirical studies have investigated ethical issues in the context of accounting organiza-

Exercising both sound professional technical judgment and ethical judgment can be difficult for CPAs because they must be able to recognize issues at both of these levels.

tions, and no published research has focused on taxation.

Interestingly, a 1986 survey of AICPA members found that more than half of the most frequently cited ethical problems confronting senior level accountants involve tax issues. Although the findings were not unexpected by many tax specialists, no published research has empirically documented the extent of ethical problems faced by tax professionals. Also, no published research has examined factors that might influence tax professionals' perceptions of ethical tax issues.

To help fill this void, Pamela L. Kiecker, Ph.D., assistant professor of marketing at Texas Tech, and I are conducting a research project designed to quantitatively assess these issues. This type of research is important because it is the first step in understanding ethical issues that involve tax accounting. Our objective with the project is to help CPAs meet their increasing responsibilities for ethical behavior within the profession and for their clients.

Furthermore, research is needed to better understand whether differences in ethical sensitivity exist at various levels of experience and responsibility, such as partners, managers, staff accountants and students. Research also provides some understanding of factors that affect the sensitivity that tax

accountants have to situations involving ethical content, including the professional and organizational environment and the CPA's personal experiences.

Exercising both sound professional technical judgment and ethical judgment can be difficult for CPAs because they must be able to recognize issues at both of these levels. This recognition or sensitivity is of particular relevance because study findings from other academic disciplines suggest that professionals tend to overlook ethical issues when they focus on technical issues.

But in order to better understand the relationship between ethical behavior and organizational consequences within a firm's tax practice, certain questions must be investigated. Some of these involve whether situational constraints in an organization can be used by supervisors to influence ethical conduct among their employees.

Often situational constraints which reward desired behavior or punish unwanted behavior may exist. And, supervisors often have a common understanding of what constitutes ethical and unethical behavior. As a result, supervisory actions also may influence tax practitioners' performance in situations that involve ethical decision making.

Our proposed research is designed to help the CPA profession meet its increasing responsibilities for ethical behavior within the profession and for its clients. The AAA ethics committee, tax faculties and accounting firms need this type of information to revise teaching and training materials to enable CPAs to focus on both technical and ethical issues relevant to their tax practices.

The accounting profession is searching for ways to influence its members to think and behave ethically, whether through education, training or supervisors' example. As tax professionals develop their abilities to recognize and address both ethical issues and the effect of supervisors in the profession, they will be better equipped to manage situations of potential ethical conflict. □

Lone Star Vintagers Concoct Texas Tastes

By Kippra D. Hopper



Photo by Mark Mamawal

Capturing interest in the wines within the state's borders is a beginning for progress, but Texas grape growers and wine makers aspire to more vast horizons.

If you drive down the stretching farm-to-market roads of West Texas, you may think you are seeing a mirage when you eye trellised grapevines beside expanding cotton fields. But the sight is no illusion.

Indeed, Texas winery operators are hoping consumers will hear through the grapevine how respectable their homegrown product is. Outsiders, like the French, are curious about the Lone Star vintages, but Texans themselves are not quite comfortable with the state's libations. Capturing interest in the wines within the state's borders is a beginning for progress, but Texas grape growers and wine makers aspire to more vast horizons.

At Texas Tech University, Steve Morse, Ph.D., an agricultural economist who grew up on a cattle ranch outside Atlanta, Ga., has joined with a chemist, Roy Mitchell, Ph.D., and an expert on tree fruits, Tim Elkner, Ph.D., to research Texas wine from viticulture (grape-growing) to enology (winemaking) to marketing.

The wine industry in Texas has room to grow. Of all the wines sold in the state, Texas-produced wine comprises only 2 percent of the market share, an unimpressive fact that incites optimism and reveals opportunity, says Morse of the Texas Tech Wine Marketing Research Institute.

In comparison, other states with emerging wine industries have a greater market share. For example, Oregon wines have 16 percent of the market share in that state, and Washington state fares even better with a 45 percent market share.

The Texas Wine Marketing Research Institute, part of the College of Home Economics, provides education, research and service in the economic development of the Texas wine and wine grape industries. The institute col-

lects and maintains data on the Texas wine industry, including consumption, production and economic impact analysis. Research and industry service projects include wine consumer surveys, a generic promotion study, Texas vineyard surveys and economic impact reports.

The lack of a generic promotion program is a handicap for the Texas wine industry, Morse declares. Researchers with the Texas Tech institute are trying to fill that gap by providing marketing studies to help Texas wineries target consumers. The state Legislature has supported those quests by funding the institute as a line item in the budget with \$100,000 yearly. Another \$100,000 goes to the College of Agricultural Sciences for enology and viticulture studies. The institute also has captured interest from both the U.S. Department of Agriculture and the Texas Department of Agriculture (TDA).

"The industry will continue to grow only with some generic promotion funds. Each individual winery can only do so much. Collectively they can do a lot. And that's where we come in. A generic promotion program should be targeted to Texas. It would help travel and tourism and help sell more wine in restaurants. You get that market share in your backyard first before you start going outside the state," Morse said.

During the summer, Morse was invited by Texas Agricultural Commissioner Rick Perry to a meeting with representatives from the state's wineries. "Perry told the group that wine was his No. 1 priority as an agricultural commodity to market in Texas. He said he's proud of the Texas wine industry, he's proud of its growth. He's going to spend some of his promotion budget on the industry. It will be a start," Morse said.

At the meeting with Perry and winery representatives, Morse presented the institute's recent publication *A Profile of the Texas Wine and Wine Grape Industry, 1991*, a 131-page report that profiles the Texas wine and wine grape industry. The report covers the industry's economic impact on the state, wine consumption and production, relevant legal issues and a directory of contacts.

Morse and his researchers found:

- Texas is the sixth largest wine producing state in the United States.
- In 1975, only two wineries were operating in the state, and 6,000 gallons of wine were produced. By 1991, 26 wineries had been formed, and production increased to 1.1 million gallons.
- Of the 3,200 grape wine producing acres in the state, 84 percent of the land is in West Texas. The High Plains area, in the northwest corner of Texas, leads the state with 49 percent of the total acreage. The Trans Pecos area, in the southwest corner of the state, follows with more than 35 percent of the wine grapes produced.
- The 1991 Texas winemaking and grape-growing industries resulted in an estimated direct economic impact of \$33.7 million and an indirect impact of \$63 million, for a total economic impact of \$96.7 million on the Texas economy.
- Directly and indirectly, the industry adds 2,430 jobs to the Texas economy.
- The combined excise and sales tax revenue collected on 1991 Texas-produced wine resulted in an estimated total economic impact of \$5.6 million.
- In Texas, 17.1 percent of wine sold is imported while 82.9 percent is U.S. domestic wine.
- In 1990, the total United States market experienced a small decline, less than half of 1 percent, while the Texas market increased by 1.6 percent over 1989.
- The yearly national average per capita consumption of wine is 2.96 gallons per adult. Consumption in Texas is 2.4 gallons per adult per year, ranking the state 30th in per capita consumption of table wine in the country.
- The United States ranks sixth in world-wide production. With 460 million gallons in 1989, the United States yielded just one-fourth the amount of wine produced by Italy or France.
- Most of Texas' wineries produce less than 15,000 gallons, and only four wineries produce more than 75,000 gallons.
- Outside the state, the area that purchases the most Texas wine is Europe, especially France and Italy.
- Table wine accounts for 95 percent of the wines produced in Texas. Table wine is defined as wine with an alcohol content of not more than 14 percent, a distinction governed by the U.S. Department of Treasury Bureau of Alcohol, Tobacco and Firearms.
- Research in the San Antonio and

Houston markets reveals that blush wines are more popular than the whites and that white wines are more popular than the reds.

- Table wine consumption in Texas increased by nearly 5 percent from 1989 to 1990, while United States consumption increased by less than 1 percent.
- St. Genevieve winery in Fort Stockton, with a 1,200,000 gallon storage capacity, is the largest winery in Texas. Lubbock's Llano Estacado is second with a 213,000 gallon capacity, while Cap Rock Winery (formerly Teysha Cellars) ranks third with 165,000 gallons. The third winery in the Lubbock area, Pheasant Ridge, is ninth with 42,000 gallons.

Among numerous future projects to heighten the promotion and acceptance of Texas wine, the Texas Tech institute is working with the TDA to promote Texas agricultural products by creating food and wine pairings with Texas wines and Texas foods, a plan called the "Totally Texas Menu."

The institute, in conjunction with the college's restaurant, hotel management program, is beginning a pilot project in Lubbock to teach restaurant wait staff more about Texas wines.

"Industry representatives tell us they face difficulty in marketing their wines to restaurants. In this project, wait staff will learn how to taste wines, how to sell wines, how to suggest wine pairings with their customers and how they can make more of a profit by selling Texas wines," Morse said.

An institute graduate associate, Tim Dodd, is working to develop wine trails in Texas for the travel and tourism component of the wineries, a project that especially will benefit smaller operations.

"The TDA and the Texas Department of Commerce are interested in this project because it will boost the economic development in the industry," Morse said. "A lot of these smaller wineries depend heavily on that tourism traffic."

Dodd is trying to determine what tourist market exists for the wineries and what types of tourists currently visit wineries, whether they are out-of-state or in-state visitors.

"Especially at some of the smaller wineries, tourism can generate well over 50 percent of their sales. They rely very heavily on people coming through



Photo by Artie Limmer

their winery, trying their wine and then selling them the product,” Dodd said.

Dodd currently is working toward a doctorate in consumer economics through the College of Home Economics. Before coming to Texas Tech, he worked for the grape growers in New Zealand, his native country, a place that also has an emerging wine industry.

To assist larger wineries, Morse and another research assistant, Marc Michaud, are tracking Texas wine sales in grocery stores, where 30 percent of all wine is sold. After a marketing research firm, Information Resources Inc., tracks the sales through universal product codes, the institute researchers work with the data base, compiled from the past two years, to study buying trends.

“People are buying wine where they are buying food. We know what brand

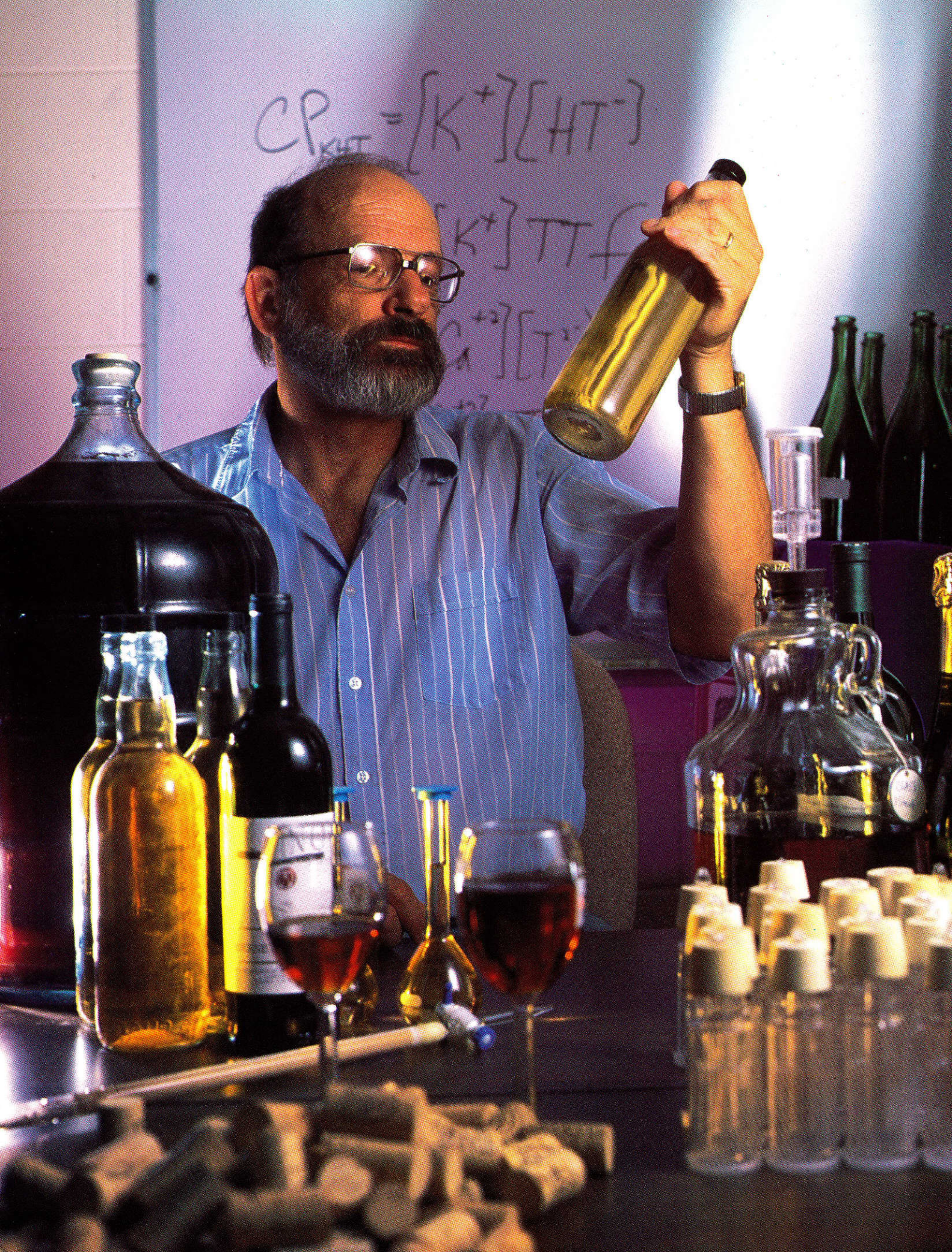
of Texas wine is sold, what day it’s sold on, what price it’s sold at, whether it was on sale or in a special display, et cetera,” Morse said.

“The universal product code goes down to the very core of the matter. It’s all very specific. My job is to manipulate the information so that members of the Texas wine industry can compare themselves directly with its competitors,” Michaud said. “We can gather the information and organize it in such a way as to compare the varietal Chardonnay versus all other white varietals, for instance, or all the red varietals versus the white varietals or the generics versus the varietals.”

Michaud currently is serving an internship with the Texas Wine Marketing Research Institute. He is completing studies at the International Wine and Vine Office, an educational entity

Above: Steve Morse sees only opportunity for growth when considering the slight market share that Texas wines have in the state.

Right: Roy Mitchell, who has spent more than 20 years researching the properties of quality wine, notes that chemistry is the main language of winemaking.



which offers a degree program through the University of Paris.

"There's a lot of work to be done in this country as far as wines are concerned," Michaud stressed. "The way our country deals with wine is not at all the way most of the world deals with wine because of cultural reasons. And when it comes to international negotiation, trade, commerce and legal issues, it can become disastrous."

Michaud said one of the goals of the International Wine and Vine Office is to standardize all of the regulations and legal issues concerning wines throughout the world.

Morse emphasizes that among Texas commodities wine is unique because the raw product is grown in the state and also is processed in the state. "The TDA and Perry are so enthusiastic about Texas wine because this industry is a great model for value-added agricultural processing in the state."

Morse notes that research is very important to the state's wine and grape-growing industry. He points out that among Texas wineries, there are a small number of large producers and a large number of small producers, making statewide marketing difficult.

Mitchell agrees: "Wine is a sophisticated commodity. Marketing begins with the grower. Winemaking is technologically challenging, and grapes are a tough crop to grow. It is difficult to draw a picture of the industry because no winery is the same."

The Texas wine industry began more than 300 years ago. In 1662, a century before wine was made in California, Spanish missionaries planted grapes at the Ysleta Mission near El Paso to produce sacramental wine. By 1900, more than 25 Texas wineries sold wine within the state. All legal wine production was halted during Prohibition, 1919-1933. The oldest existing winery in Texas is Val Verde Winery, located in Del Rio and established in 1883. Val Verde is owned by a third generation winemaker, Tommy Qualia, a Texas Tech graduate.

The growth of the modern Texas wine industry began in the 1970s when the "wine revolution" reached Texas. Mitchell and Clint McPherson, both chemists, and Bob Reed, a horticulture professor, are credited for reviving the modern-day wine industry. The three began evaluating grapes and wines as

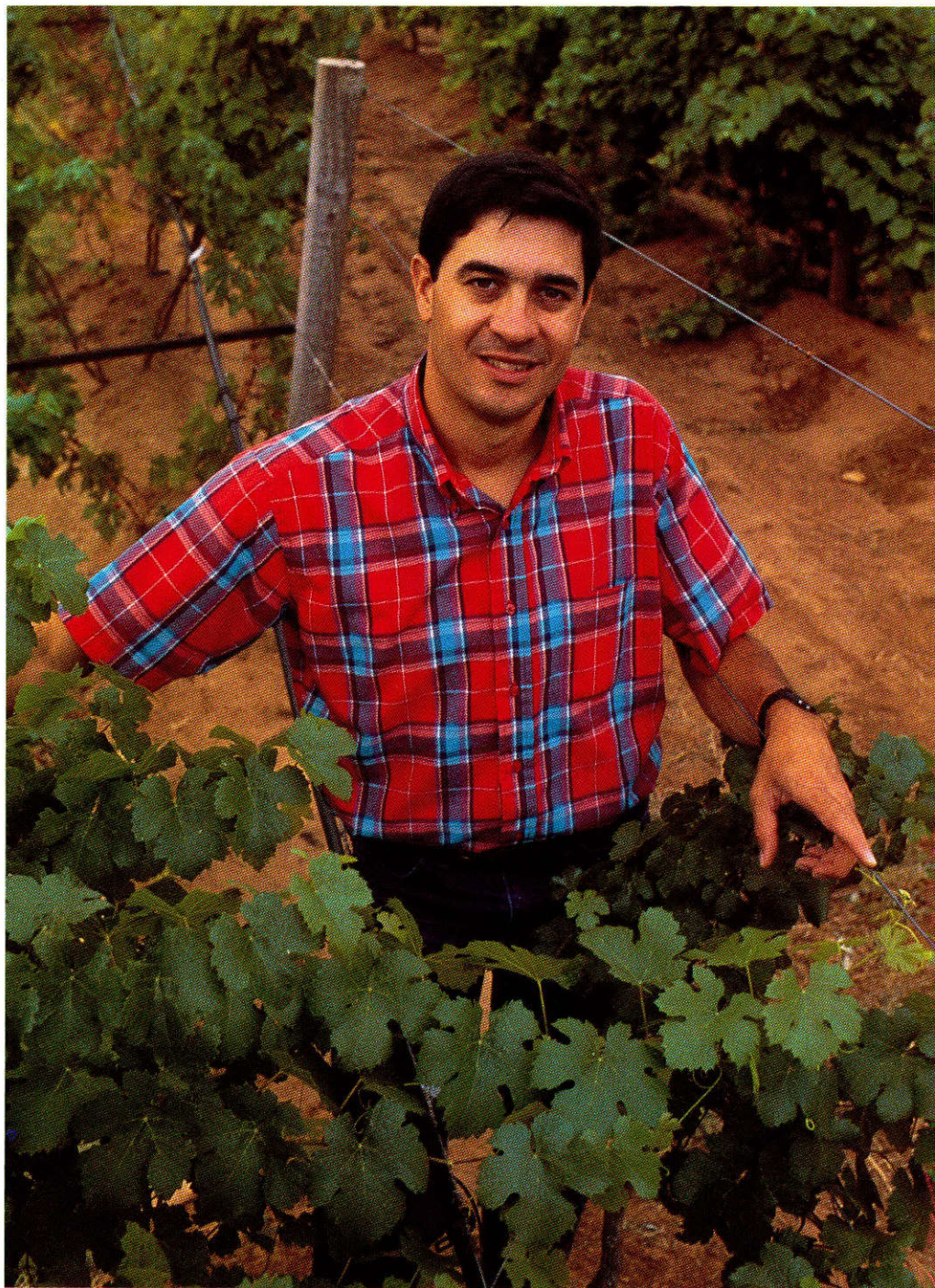


Photo by Mark Mamawal

part of a chemistry project. The McPherson vineyard was planted in 1970; the first experimental wines at Texas Tech were made in 1973.

Texas wines have since won numerous gold medals at national and international wine competitions, from San Francisco to London to Rome.

Mitchell began making wine in 1973 as applied chemistry. He has been making wine every growing season since then, and winemaking is now his full-

Viticulturist Tim Elkner, examining grapevines, explains that most of the ultimate quality in wines is made in the fields.



Morse (left) and Mitchell agree that wine-making is technologically challenging and that marketing Texas wine is difficult because no two wineries in the state are the same.

Photo by Artie Limmer

time work. His research initially focused on pH levels in wine grapes and its importance in wine quality. The level of pH is a measure of acidity and alkalinity.

"It's crucial in wine. If you have high pH (above pH 3.6), the wrong kind of microorganisms could grow and make a foul taste in the wine, and the color is off," Mitchell said. "With high pH levels, we have to use more sulfite chemicals to preserve the wine. So if we get low pH, we can use a lower dose of sulfur dioxide."

Mitchell works with viticulturalists to understand plant physiology. "We're investigating mineral uptake by the grapevine, which is influenced by water and soil and the variety you grow. Low pH in the fruit is a sign of low mineral uptake; it comes from a healthy vine."

"For dry wines, which means no sugar left, you ferment all the sugar out. Most of the classic wines are dry wines. Some of the styles of wine that are popular in the United States, for example blushes, are sweet," he said.

In West Texas, the window of opportunity for harvesting grapes is only about three days, compared to a week for California growers. Mitchell and Elkner are investigating the proper time to harvest certain varieties. They are trying to map maturity in a grapevine to determine where growers should sample properly to get an accurate determination of the ripest fruit.

"It's very common for a grower to go out and sample his fields, then tell the winemaker he believes that his grapes are 22 percent sugar. They pick them and get to the winery and they're only 20 percent sugar. The mistake that's made is almost always that the crop is actually greener than the sample indicates. So if we can get some data to show growers a better way to determine the actual maturity of the crop, then they can pick it at a better time and that ought to improve wine quality," Mitchell said.

In a third project, Mitchell is investigating new varieties of grapes that are not grown commercially in the High Plains to determine what kind of wine they make.

"There are 5,000 kinds of grapes you can grow. There's one family of grapes that represent the most important wine grapes in the world, and that's *Vitis vinifera*. Historically, France determined

hundreds of years ago which cultivar was best for each one of its regions. We've got 20 years of experience here. We're still trying to learn the best way to grow each variety. Later we'll select the best ones," Mitchell said.

The secret is in plant vigor, he says. A plant has to have enough growth to carry a crop, but too much growth creates wood that freezes. Also a large canopy on the plant will result in many problems including high pH, thus poor fruit quality.

"I enjoy using chemistry in the plant sciences. In the grapevine, we know that potassium is tied into the ripening process. Potassium content increases rapidly when the grapes get ripe. But calcium, magnesium and sodium, which are the other main minerals in there, seem to just come in with the normal water through the root system. So the plant is distinguishing between those four minerals some way. I'm fascinated by how the plant's doing all those things," Mitchell said.

Elkner, whose background is tree fruit research, specifically peaches and apples, says about 70 percent of the ultimate quality in the wine is made in the fields.

"Grapes are a much more complex plant. We put the fruit under a finer microscope, looking for very specific quality in a grape that you don't really look for in an apple," Elkner said.

"There's no cookbook recipe because there are so many factors that influence the plant, such as sunlight, temperature and rainfall. Then the plant is influenced by how you manipulate the canopy itself, how you grow the vine," Elkner said.

He explained that hot sunny days, cool nights and low humidity are keys to the success of growing wine grapes in West Texas. "The fact that it's warm and sunny means that photosynthesis is theoretically at the optimum levels and is building the maximum amount of sugars. Our cool nights help reduce respiration, which is the breakdown of sugars, to use the energy for other processes. By preserving sugars, we are ultimately increasing fruit quality.

Low humidity reduces disease problems, Elkner said. Sandy soils that are well-drained also add to the success of the crop. "The grapevines are very efficient at removing water from the soil because of a spreading, penetrating

root system. So it reduces the need for irrigation."

Elkner is collaborating with Bill Lipe of the Texas A&M Experimental Station in an evaluation of varieties and rootstocks. The researchers have plantings in Lubbock, Halfway and Brownfield where they are growing 24 varieties of grapes and 16 rootstock varieties.

"One of the things we look at is bud break in the spring. We look at when natural flowering occurs. We look at when the fruit starts to mature, when the fruit is harvested, when the vines defoliate in the fall and how susceptible the plants are to diseases. Then we measure growth in the winter when we prune them. We weigh the wood to get a measure of vine vigor, or growth.

There's a very good correlation between vine vigor and winter freeze damage (where the canes get frozen back) because vigorous vines tend to grow later into the fall and are more susceptible to early freezes," he said.

Mitchell and Elkner explain to grape growers that they have much to learn. Growers have to wait three years after planting to have any crop on their vines and six years to have a mature plant.

"What you're dealing with here in Texas is that a lot of the grape growers are cotton growers who are diversifying, and they really don't have the background in grape production," Elkner said. "It's not the same as growing cotton plants. They're struggling to try and learn how to manage the crop, and they're making some mistakes. So research is very important. Considering where we are now in relation to these mistakes, I believe the future looks very bright for wine grape production in Texas."

The personality of Texas reserves intrigue for non-Texans; the same enigma sometimes inhibits the state's own individuals from recognizing distinction within the region. And so it is with Texas wine.

Louis Pasteur said that wine is *the most healthful and most hygienic of beverages*. Plato called the libation *a remedy for the moroseness of old age*. Robert Louis Stevenson described wine as *bottled poetry*.

Texas wineries are thanking their lucky lone stars that outsiders are more than willing to try the state's wine, *the divine juice of September*, as Voltaire recognized. □

By Myrna Whitehead

Literature & Politics in Spain

When Janet Perez, Ph.D., came to Texas Tech University as a visiting professor in fall 1977, her stay was supposed to be for one year. Perez, the first tenured woman in the department of romance languages at the University of North Carolina, had been employed at that university for 10 years. She also was the first woman ever promoted to full professor in that department's history.

After a year at Texas Tech, Perez opted not to return to a turbulent personal life in Chapel Hill, N.C., but to remain a professor in the then department of classical and romance languages at Texas Tech.

Educated at Duke University, she received her master's degree and doctorate in romance languages in 1957 and 1961, respectively. Perez conducted post-doctoral study and research on post-Civil War Spanish novels while a Fulbright Scholar at the University of Madrid in 1961-62.

"Initially, the appeal of language and linguistics was very strong for me. As it happened, at Duke I did not have the possibility of majoring in linguistics," Perez said.

Her interest in language shifted to literature and its philosophical dimensions, and she decided to focus on the works of Jose Ortega y Gasset, one of two major Spanish philosophers of the 20th century. Ortega y Gasset had died shortly before Perez chose the topic for her dissertation.

"He had been relatively unstudied in Spain for the previous 20 years largely due to political reasons," Perez said.

Having never lived in Spain prior to her Fulbright appointment, Perez was fascinated to discover how the social and political contexts affect literature. She became especially interested in the effects of censorship imposed by Francisco Franco's totalitarian government. Franco's regime essentially prohibited writing about the Republic, its artists and its intellectuals, she noted.

"It wasn't until after living there that I developed a feeling for the kind of interaction that happens between the

society and the literature," Perez said. "Living there in subsequent years, I became interested in the sociology of literature and the ways in which writers circumvent censorial restrictions.

"In Spain, these applied to politics, including representation of government and military figures, religion and general morality," she said. "There were tight restrictions on these and the portrayal of sexual relationships, crime, the use of offensive language and attitudes toward authority. Conversely, for many years, writers could not mention Spaniards in exile or anything favorable to the losing side in the Civil War.

"I wondered about the ways that a writer, who chooses to stay in his or her country rather than going somewhere else where it isn't necessary to fight the censorship, can somehow hoodwink the censors and manage to convey a message," Perez observed. "I became fascinated with ferreting out the complex of techniques, rhetoric and mechanics of dissent in a totalitarian society where, if the censors realize what you're doing, you'll end up in jail."

The study of Ortega y Gasset

expanded to a specialization in 20th century peninsula literature (meaning Spanish literature of the Iberian Peninsula as opposed to that of Latin America). Although her primary language is Spanish, Perez said she is familiar with several languages spoken in Spain. However, those languages were outlawed under Franco. Castilian Spanish became the country's official language 500 years ago, and it continued to be favored by the government until 10 or 15 years ago when the other languages gained legal rights.

For 40 years, Perez observed, people who spoke the minority languages were handicapped. Franco outlawed the vernacular languages because they were associated with independence or separatist movements. After the first 20 years of Franco's regime, the speakers of the Gallego and Catalan languages managed to gain the freedom to publish certain restricted works in their own languages, but they were not allowed to have newspapers. These and other vernacular languages were forbidden in schools, and for many years, citizens were not allowed to speak the minority languages publicly.

Janet Perez is interested in literature and its philosophical dimensions.



Photo by Artie Janner

One of these languages, Catalan, is the seventh language of Europe in the number of speakers: More than 9 million people in northeast Spain and southern France use Catalan. Although almost unknown for decades, Catalan is spoken more widely than Swedish or Danish, she noted.

Gallego, spoken in northwest Spain, is closely related to Portuguese, Perez explained. Catalan is harder for the average Spanish speaker to understand, she added, because linguistically it falls somewhere between Spanish and old French. Literary traditions in Catalan and Gallego are older than Castilian, but were interrupted by prohibitions several times in past centuries.

During the Franco regime, literature in Catalan became increasingly available, but literature in Gallego was almost totally obliterated. The Gallego language and literature were nearly assimilated because Gallego speakers generally were rural, uneducated and poor.

"Catalan was spoken up and down the Mediterranean Coast, especially in Barcelona and the area north and south of Barcelona, which was the most productive part of Spain agriculturally and the most industrialized," Perez explained. "Economic power was greater there, and the people were better educated, better able to protect their language from assimilation."

In addition to her interest in language and culture, Perez presently is studying women's writings. Her latest book, "Women Writers of Contemporary Spain," published by G.K. Hall in Boston in 1988, focuses on Spanish women narrators of the 20th century. Currently, she is working on a book of 20th century women poets with an introductory chapter on 19th century women poets.

"I had always studied novels, but the poetry, especially by women, is a new area for me," Perez said. "Until recently, only a handful of women throughout Spanish literary history had been exceptions to general critical neglect."

Spain lived under Moorish domination for centuries, and Arabic culture still exercises a powerful influence, with women being confined and restricted both physically and intellectually. For centuries, those who wanted anything other than marriage and motherhood had no choice but the convent,

which was the only avenue to a life of study or writing. Recent investigations have unearthed the names of some 2,000 women writers of past centuries; a large number of them were nuns.

Authors such as St. Teresa of the 16th century (1515-1582) and Emmalia Pardo Bazan of the 19th century, whose works might be termed the Spanish equivalent to a female Charles Dickens, are familiar to most people with degrees in Spanish literature, Perez said. However, she added, hundreds of Spanish women writers past and present remain virtually unknown.

"Up until the present century, Spanish women were forbidden to attend universities, and most women were not educated," Perez said. "They were looked upon as not being intellectually equal to men. So, those who wanted to write often used male pseudonyms which complicates locating earlier women writers and their works. Ironically, today some of the best and most exciting writing in Spain is being done by women."

Perez has taught classes in all levels of the Spanish language and in most areas of literature except medieval literature and some aspects of Latin American literature. She was named a Paul Whitfield Horn Professor at Texas Tech in 1986. This recognition is the university's highest honor for faculty members.

Perez has served on more than 30 editorial boards, and since 1974 she has been the general editor for more than 100 volumes on Spanish writers published in the Twayne World Author Series. Her own books include "The Major Themes of Existentialism in the Works of Ortega y Gasset," "Ana Maria Matute," "Miguel Delibes," "Gonzalo Torrente Ballester" and "Critical Studies on Gonzalo Torrente Ballester."

Perez also serves on the planning committee for the Centro de Estudios Hispánicos (Center for Hispanic Studies), a proposed cooperative venture between several departments intended to increase Hispanic participation in the economic, social and cultural life of Texas and to encourage studies of Hispanic peoples and cultures. The project was scheduled for legislative funding but is currently on hold.

For the past 10 years, Perez has been working on "The Dictionary of the Literature of the Iberian Peninsula"

with co-editor Maureen Ihrle. Started 20 years ago, the undertaking was initiated by German Bleiberg, who died in 1991. The dictionary augments and updates an earlier Spanish edition which was published in the 1970s.

"I was first asked to be an associate editor on this because some people considered me to be an expert on the 20th century, and Bleiberg and Ihrle were experts on earlier centuries," Perez explained. "When we started this, I did not expect it to last a decade, even though the 20th century required major changes while the earlier centuries did not need much modification. Including exiled persons, women writers, writers in the minority languages, and new, younger writers, resulted in some 900 additional entries for the 20th century."

"This will be a major reference work which will probably end up in all of the libraries of the English-speaking world," she said. The two-volume dictionary is slated to be published later this year by Greenwood Press in New York.

With more than 140 articles, Perez is internationally known for her studies of 20th century Spanish literature. She is a consultant to several national organizations in the humanities and to various publishers. Her accomplishments have garnered the educator numerous prestigious awards including Texas Tech's Graduate Dean/Vice President for Research Special Award for Scholarly Distinction in 1980, the Dean's Outstanding Research Award in the College of Arts and Sciences in 1989 and 1991, the Award for Distinguished Faculty for the College of Arts and Sciences in 1990 and the Outstanding Researcher in the College of Arts and Sciences in 1992. Perez also was a nominee for the President's Academic Achievement Award in 1991.

"As soon as I finish the book on the women poets, I have several other long-term projects that have been half-way to becoming books for longer than I like to remember," Perez explained.

One book focuses on post-Civil War exile and another targets the impact of Cervantes on 20th century Spanish writers.

"And about 10 other projects would be books by now if I had figured out how to give up sleeping," Perez added. □

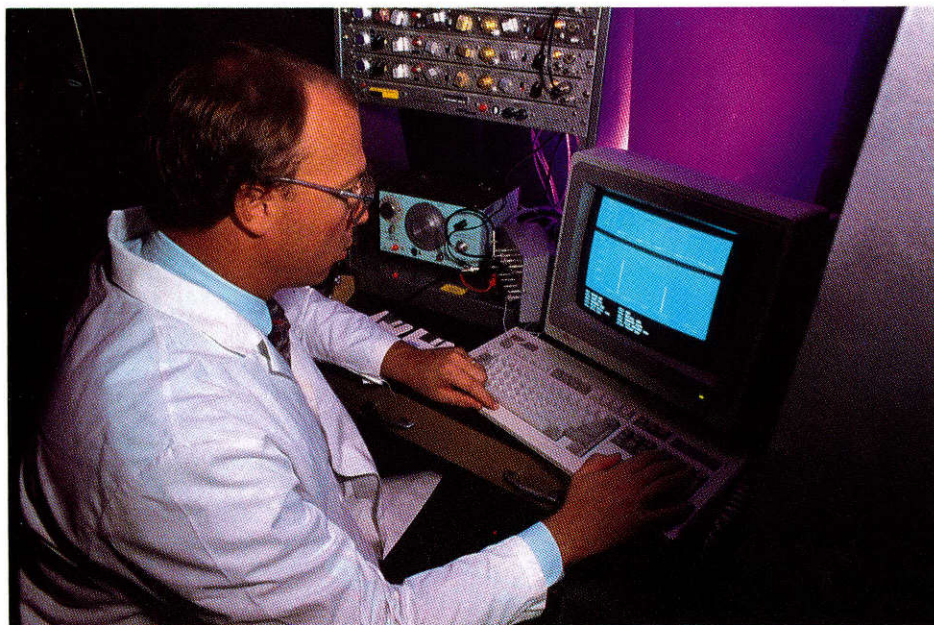
The Eyes: Gateway to the Body

By Jim Barlow

In the "Phaedrus," Plato described sight as "the clearest of our senses, clear and resplendent." Today, scientists in the department of ophthalmology and visual sciences in the Texas Tech University Health Sciences Center and chemists from the Texas Tech University campus, working together in a unique Drug Design Center, see the eyes as the body's gateway. By tackling problems of the eyes, the researchers hope they can help treat some of the body's other ills and injuries.

The researchers are using what Ted Reid, Ph.D., co-director of the HSC's Ocular Cell Biology Laboratory, calls "a rational approach to drug making" that takes advantage of rapidly advancing technology to identify particular eye problems and solve them through a collaborative effort that results in a specifically designed and thoroughly tested drug.

Photo by Mark Mamawal



For one team to manage the entire process of new drug creation, from initial design through final testing, is unusual in a university setting and is only found in a few large drug companies, says Reid. "Until recently, almost all drugs were discovered by chance, from herbs and things people used from the old days," Reid said. "When drug companies found that these old remedies worked, they would take the natural compound and start modifying it. In some cases, the compounds were poisons that would block some function, and researchers would modify that. More recently, they've turned to what we call more rational drug design."

The Texas Tech and HSC researchers are combining computational chemistry, nuclear magnetic resonance spectroscopy and synthetic organic chemistry techniques with cell biology, pharmacology and clinical medicine in their design, manufacture and testing of new ophthalmic drugs.

The process begins with an understanding of how pathways in the body work and then identifying a natural compound whose molecular structure fits and controls a particular pathway, Reid said. Molecules control the pathways when they bind to specific receptors on a cell. The receptor then tells the cell what to do, such as to grow.

"What we want to do is to make a synthetic molecule that has all the structural features of a natural molecule, but we want it locked in a preferred configuration," Reid said. "In that desired shape, the drug has more specificity and potency, and thus one needs less. We can increase the potency and specificity up to 1 million times or more, thereby decreasing harmful or unwanted side effects."

The Drug Design Center involves Reid and Craig Crosson, Ph.D., of the HSC's department of ophthalmology and visual sciences and David Birney, Ph.D., and Robert Walkup, Ph.D., of Texas Tech's department of chemistry and biochemistry. The proposal for the Drug Design Center was drafted in

Craig Crosson examines data on physiological changes to the retina following exposure to a flash of light.

October 1991, but the center is still in its formative stages. Although the team is targeting specific ophthalmic problems — from corneal ulcers to cancers to diabetic retinopathy — the research may have other medical applications.

“Ophthalmology is an interesting subspecialty, because the eye has a lot of properties that allow you to do things that you cannot do elsewhere in the body,” said Reid, who came to Texas Tech in June 1991 after 14 years on the Yale University faculty and seven years as director of ophthalmic research at the University of California at Davis. “From a drug design standpoint, it’s an ideal system to deal with.”

Because the eye is on the surface of the body, drugs can be easily delivered through topical administration. The eye allows researchers to study the vascular system, central nervous system and even brain function, says Reid. Researchers have access to specific target tissues in the eye because the tissues are localized. The eye also has properties similar to the skin and to the kidney. Solving specific ophthalmic problems should provide information about other areas of the body, Reid says.

Researchers are attempting to synthesize a variety of molecules in the proper shapes, or conformations, so that when a synthetic molecule is applied to a wound, it will trigger the desired healing response. One molecule being targeted is Substance P, a small protein consisting of a string of 11 amino acids and found in specific nerve endings of the body.

Substance P, a neurotransmitter and peptide, was initially isolated in 1931 by U.S. von Euler and J.H. Gaddum from a crude extract of equine tissues that displayed a variety of physiological effects. In 1971, S.E. Leeman isolated the substance. For decades, scientists associated its primary activity with the transmission of pain.

Reid has determined that eye wounds are healed by growth factors from three separate pathways in the body: nerves, blood cells and from other cells that release growth factors into the blood stream. When one pathway is defective, wounds don’t heal properly. Reid has found that Substance P, which is released by specific nerve cells, promotes cell growth, particularly the epithelial cells involved in wound

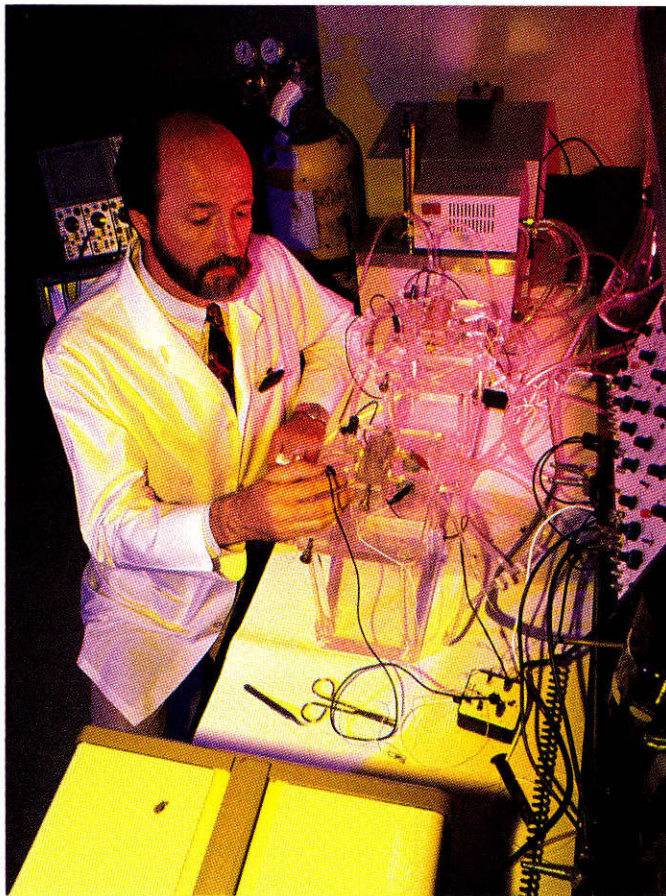


Photo by Mark Mamawal

Ted Reid measures the physiological processes of transporting tissues of the eye.

healing.

In collaboration with a veterinary ophthalmologist, Reid has successfully treated neurotrophic corneal ulcers in dogs using Substance P in eye drops. Researchers suspect that nerves play a developmental role in the painful ulcers, in which cells attempt to grow across the wound but don’t attach properly. After one week of treatment, nine of 10 dogs that had suffered from the ulcers for one to two months were healed. The dogs’ owners reported that their pets appeared pain free after one day of treatment.

“That success means that Substance P possibly can be used as a drug to promote wound healing,” said Walkup, an associate professor who earned his doctorate at Stanford University while performing research in synthetic and bio-organic chemistry with renowned chemist Carl Djerassi. “And there are places, particularly ocular lesions in the eye, where wound healing is a problem.”

Reid says Substance P may play a key role in healing wounds with compromised nerve involvement, such as dia-

betic ulcers or burns. “When you suffer a burn wound, you’ve essentially seared off all those nerve endings and they can’t release this peptide,” he said. “Consequently, you have trouble with the skin reattaching. We want to design and produce a new Substance P that works better than the old Substance P so we can use it in very low concentrations and promote this kind of healing.”

Walkup says the project may be applicable to numerous chronic injuries that fail to heal properly or timely. “It is hoped that as people better understand Substance P, then they can better understand wound healing, and thus improve the healing process,” he said. “The challenge is to develop a therapeutic agent, particularly one that can be used in the human eye as eye drops, that is based on Substance P.”

To prepare an analogue of molecule that mimics Substance P, Birney, an assistant professor and an expert in molecular computational and structural design, and Walkup are studying the structure of Substance P in three dimensions to identify an overall

molecular topology, or shape.

The idea is that when a mimicking synthetic substance is applied to a wound, it will be absorbed by cells and bind at the surface of a receptor protein at the same site that normally binds to Substance P. The problem with designing such a mimic is that small proteins like Substance P exist in a state of constantly changing shapes, making it difficult to identify the precise shape that binds to the receptor and triggers the desired wound healing, says Birney, who earned a doctorate from Yale University in 1986 and did post-doctorate work in molecular calculations at the University of California at Los Angeles.

"Substance P is like a chain or a rope," Birney said. "Every time you throw it on the ground, it takes a different shape. This is a short rope, but it still has a lot of different shapes that it can attain. Our problem is that there is only one shape, probably, that fits the biological activity that we want. What we're looking for is one or just a few particular coils of the rope."

Birney's structural and computational studies of Substance P should allow the research team to reduce the number of possible desired conformations of Substance P. Once that task is accom-

plished, the researchers will design a completely new molecule that they hope will produce the desired healing activity of wounded cells. Work on a possible synthetic mimic of Substance P, partially funded through a \$10,000 seed grant from Texas Tech's Institute for Biotechnology, already is underway by Derek Cole, a postdoctoral fellow who recently earned his doctorate at the University of Alberta.

After the design of synthetic molecules, which Birney and Walkup believe will bind to a specific Substance P receptor, Crosson will study the physiological functions triggered by the synthetic compound to determine how it translates its signal into a cellular response.

"You can have a variety of cellular responses depending on the cell you're interested in," said Crosson, who holds a doctorate in physiology from Colorado State University. "Questions we ask are, 'Are all Substance P receptors created equal? Are they all the same?' There are usually subclasses of any given receptor. What pharmacology is ultimately interested in is selectivity, to effect only one response within the body. I'm out to understand all the receptor subtypes by measuring various

known physiological responses to Substance P, or to any other agent. But as you change the agent, you're going to change the way in which you look at it."

At weekly meetings, the researchers attempt to reduce the distinctions between their separate fields, Reid said. Such a collaborative effort also helps break down the traditional basic science approach to research.

"Our goal as scientists is to improve health care within the United States, but accomplishing that goal anymore requires a multidisciplinary approach," Crosson said. "You can add your brick to the wall and then let another group from another institution do something with your data, but that's a very inefficient process. And, oftentimes, it's not very fulfilling to individuals because they all would like to see something tangible come from their research."

Walkup agrees: "We must work together throughout the process to understand how the pieces must fit. Crossing the specialty among a group of researchers allows for seemingly naive questions that represent legitimate concerns."

A possible benefit for ophthalmology, Reid says, could be the synthesis of new molecules to be used as biological glues that could close wounds without sutures. Such a development could be a boost for contact lens wearers.

"We'd just peel off the epithelial cells on the surface of your eye and permanently attach a living contact lens with these biological glues," Reid said. "The epithelial cells would regrow over the attached lens. The nerves would grow into it, and it would behave just like your normal eye, but the eye would be corrected for all your visual problems. You have to have transparency, flexibility and structural integrity to develop such a permanent lens. You have to understand nerve growth, re-epithelialization, biocompatibility and a lot of cellular attachment problems. Ours is not a limiting project, and so it's the kind of thing that's fun."

The overall project, researchers hope, will be visionary, clear and resplendent. □

(Susan Truesdale, medical-science editor for the department of ophthalmology and visual sciences, contributed to this report)

Robert Walkup (standing) and David Birney study a computer simulation of one possible conformation of Substance P.

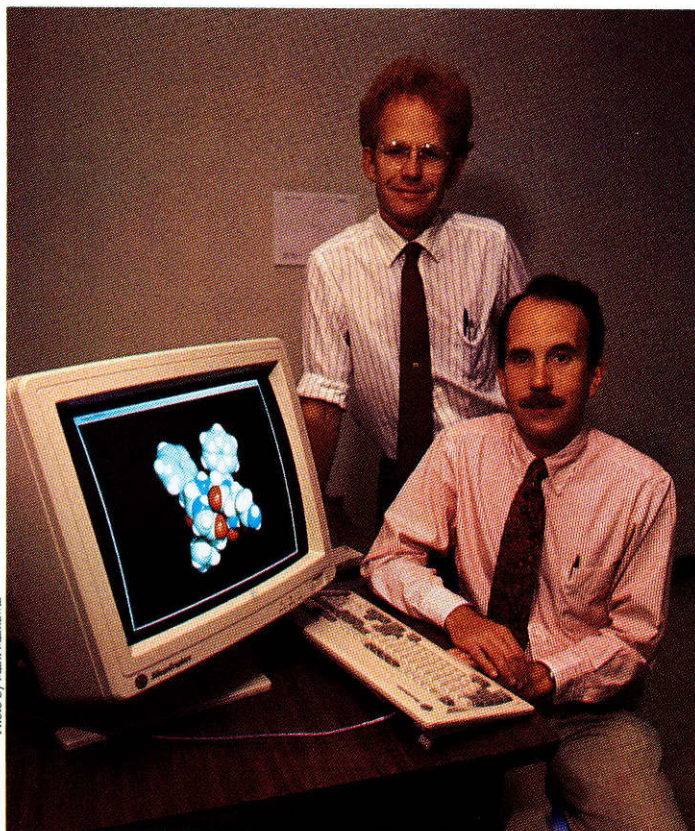


Photo by Mark Mammaw



Photo by Artie Limmer

The Slow Dimming of the Mind

By Preston Lewis

Slowly but surely more and more Americans are losing their minds each year to Alzheimer's disease.

As inexorably as the march of time, the disease is dimming the minds of an estimated 4 million older Americans and challenging the nation to cope with the result.

"Within the next decade," says Texas Tech neuropsychologist David M. Freed, Ph.D., "the number of people with the disease will outstrip available services for long-term medical care."

Alzheimer's may be the ultimate conundrum of modern medical science. On the one hand, medical science has extended our national longevity by 20 years since the turn of the century. On the other hand, the longer we live the more likely we are to get

Alzheimer's.

What is so frustrating about Alzheimer's is the slow wasting away of a person's mental capacity. Classically, it begins with recent memory loss and ultimately progresses to total incapacity.

Julius Trauer, 85, of Hart has Alzheimer's. He can remember the name of his second grade teacher, but not what day of the week it is. Although he retired more than 20 years ago, he can still remember the stops in his South Texas sales region when he was a salesman for the Gold Seal Co. He can't, however, remember what he had for dinner last night.

"I began having memory problems about five years ago," he said, "but I was forewarned. My older sister had Alzheimer's."

Ena married Julius 15 years ago and has come to accept her husband's forgetfulness, his repetitive questions and

his frustrations.

"You can't let things like that get you down," she said, "because you have worse things ahead. We just keep working together."

It worries him that he sometimes forgets things that make sharing a life as husband and wife special.

"I have a little trouble remembering our wedding anniversary and her birthday, but I know it's in the fall of the year," he said. "By summertime I start asking her when her birthday is and when we got married."

Once a month, the Trauers come to Lubbock to the Texas Tech University Health Sciences Center where he is participating in clinical drug trials of a

Individual brain cells provide the backdrop for neuroscientist Shirley Poduslo's research into aging.

DuPont Merck drug, Linopiridine. Texas Tech's department of medical and surgical neurology was one of some 30-plus sites selected nationally to test the drug designed to treat the memory and attention deficits associated with early Alzheimer's.

The medical and surgical neurology department is developing a reputation statewide for its expertise in the neurology of aging. Joseph B. Green, M.D., who chairs the department, has recruited to Texas Tech researchers such as Freed, neuroscientist Shirley Poduslo, Ph.D., molecular geneticist Janice Kurth, Ph.D., and clinicians Matthias Kurth, M.D., Ph.D., and John Schwankhaus, M.D. The health sciences center is also attracting more volunteers for the Linopiridine trials and for safety studies of an experimental drug, Cognex, than medical facilities in much more densely populated areas.

It would be nice — and news — if the drugs under study at Texas Tech were cures, but the best anyone is hoping for is an effective treatment for some patients. Even if the best these or any other drugs could do is delay the onset of the disease's incapacitating symptoms, it could still save the country millions of dollars in nursing home costs.

"Alzheimer's is," said Freed, "not just a medical problem but a significant issue we must face because of its ramifications for society, for medical insurance, for service provision, for long-term health care provision and for the emotional burden a family must carry."

It is also a disease, said Freed, that has brought about "a crisis of confidence in scientific circles." The reason is that scientists have for decades believed the dementia of Alzheimer's disease had a common cause. Freed is one of a new breed of scientists who think the disease may have dozens of contributing causes and those causes will vary by individual.

Just as the body will be scarred over the course of a lifetime from cuts, burns, bruises, fractures and other injuries, Freed thinks the brain might also be scarred as it ages.

"The brain is an incredibly power hungry organ," Freed said. "A quarter of your blood supply, oxygen and glucose goes to support a couple pounds of brain tissue. If you cut that supply off, even for a couple seconds, you increase

the stress on the neurons and risk compromising the brain."

The neurons are the nerve cells which send the signals required to think, to walk, to talk and to do all the things that keep the body running. All the neurons we will ever have — and there are billions of them — we are born with. Once neurons are damaged or die, they are not regenerated or replaced.

The brain's hallmark indicators of Alzheimer's disease are extracellular senile plaques and neuronal processes having neurofibrillary tangles. The definitive diagnosis of Alzheimer's disease is by autopsy in conjunction with a patient history. While several cell types may contribute to the formation of plaques, tangles are abnormal proteins found in neurons. When a neuron gets sick due to the presence of tangles, it can no longer perform its function. If no other neuron can assume the duties of the compromised neuron, then that brain function is slowed or lost entirely.

"We know for fact that plaques and tangles are found in a number of other diseases so it may well be that they are nonspecific reactions by the brain to a variety of insults," said Freed. "For Alzheimer's, we may be looking at a host of converging factors such as heart disease, kidney disease, lung disease, liver disease, emphysema, asthma, anything that could chronically influence the brain."

Freed speculates that the myriad of potential contributors to potential brain insults could ultimately converge into a handful of common disease paths.

Freed developed this idea of multiple Alzheimer's causes while working on his dissertation at Massachusetts Institute of Technology. This hypothesis seemed to be an explanation why some experimental drugs worked with some Alzheimer's patients but not for others. Freed began to classify symptomatic subgroups of Alzheimer's patients by initial symptoms to try to predict response to medications.

Of the initial symptoms, recent memory loss is common in 50 percent of Alzheimer's patients. This is the classic Alzheimer's symptom with onset after age 65 and a relatively slow progression. The memory loss may be caused by a cholinergic dysfunction that prevents the nerve endings from liberating the acetylcholine necessary

for memory. This is the disease course typically associated with the one-source theory of Alzheimer's.

However, Freed's initial studies show three more disease paths based on initial symptoms. About 20 percent of Alzheimer's patients undergo psychiatric changes which can include hallucinations, delusions, aggression and hostility. This disease course, which may begin before age 65, may be attributed to malfunctions of serotonin and dopamine production, two chemicals whose functions are not fully understood in the brain.

Another 20 percent of Alzheimer's patients have selective attention problems as the initial symptom. These patients, most often female, are easily confused or perplexed. These symptoms appear related to another chemical dysfunction in the brain, this time involving norepinephrine, which may play a role in attention and concentration.

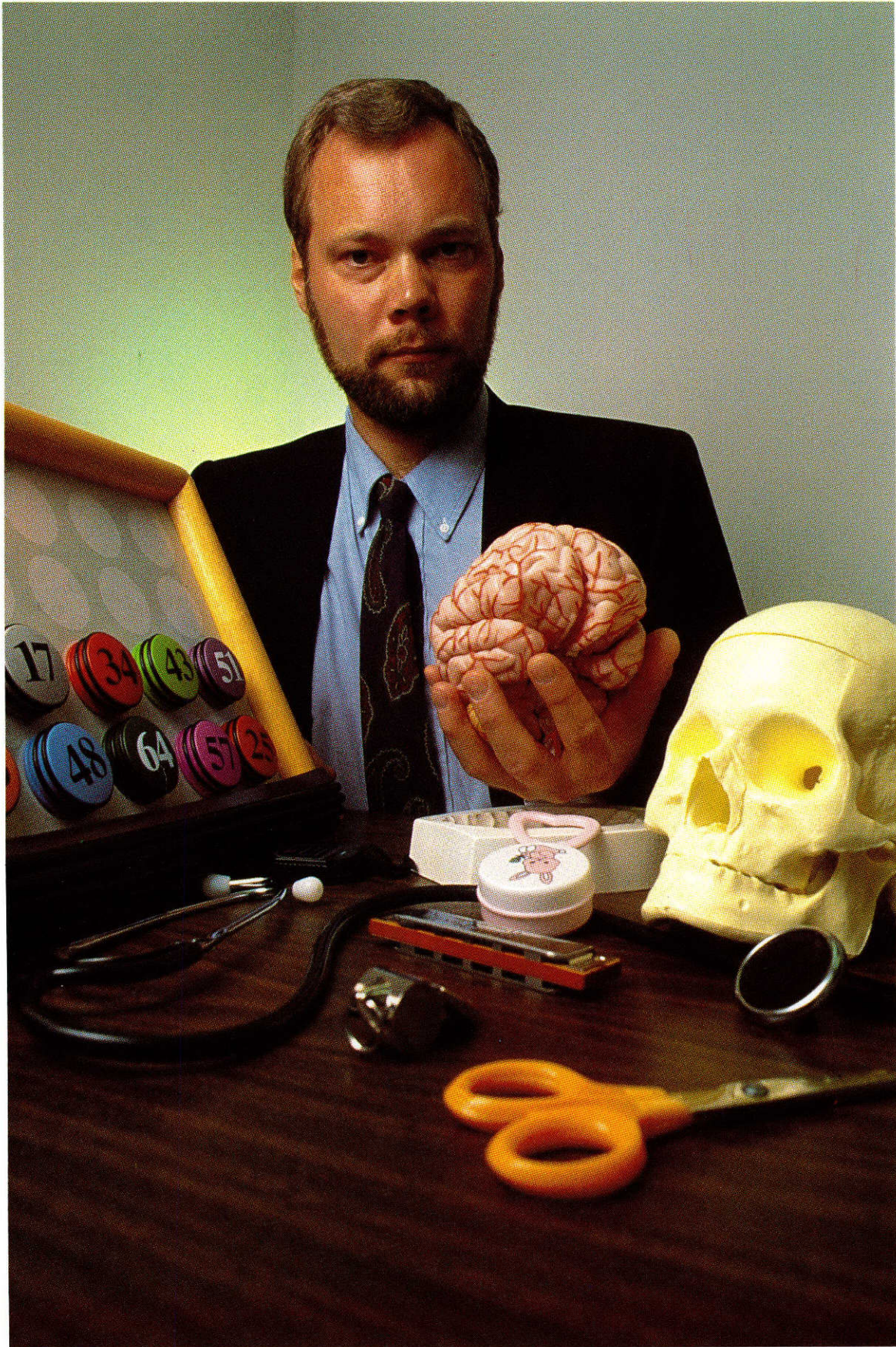
The final 10 percent of Alzheimer's patients, by Freed's analysis, show first symptoms of difficulty with expressive language. These patients have difficulty finding the right word, followed by rapid deterioration of language. Onset is before age 65.

Freed said, "We need to know how the disease presents itself in its various forms if we are ever to find effective treatments, much less cures."

Shirley Poduslo of the neurology faculty is approaching the problem from a different direction, looking at the genetics of Alzheimer's. Studying the genetics may help predict different patterns, different symptoms and different responses to treatment.

Her research uses very sensitive molecular analysis to identify polymorphisms or changes in the receptor genes which react to chemicals called neurotransmitters produced by other neurons. Changes in the receptor genes can interfere with the neurotransmitters' intercellular communication among neurons. If the receptor genes are defective, the neuron will not function properly. If the receptors are so damaged they cannot receive messages, the neuron itself will die.

"You're born with such an excess of neurons that generally the loss doesn't hurt," Poduslo said. "There's probably a critical time, though, when you start to get older that it does make a difference.



Items as recognizable as a whistle, a pair of scissors, a stethoscope or a harmonica are used by neuropsychologist David Freed for testing the memory of suspected Alzheimer's patients.

Photo by Artie Limmer

And if neurons in a certain area that do a certain thing are lost, there's nothing to take their place."

Though memory is stored throughout the brain, Alzheimer's consistently affects three parts: the hippocampus, important in converting recent memory into long-term memory; the basal forebrain, which plays an important role in integrating subcortical functions; and the limbic system involved in behavior.

To get at the genetics of Alzheimer's, Poduslo studies the DNA or deoxyribonucleic acid — the cellular blueprint for our bodies — from Alzheimer's patients and their families. By taking blood samples from patients, Poduslo's team of researchers isolate the lymphocytes which contain the DNA and then develop a culture that will provide a permanent, replenishable cell line for each patient.

Samples of DNA then are amplified and biochemically broken apart by enzymes so specific gene fragments can be studied. These genes fragments can be compared with those of some 40 families used worldwide in Alzheimer's research. Poduslo is gradually building a "library" of cell lines from two and three generations of a patient's family. These multi-generational cell lines may help determine the role of heredity in the disease.

Thus far, Poduslo's research has identified a change in the gene for the dopamine receptors as a potential contributing factor to Alzheimer's. The genes for the dopamine receptors are located on chromosome 11 and the technology in her research has been sensitive enough to detect on those receptors a change in a single basepair, the coding strands which provide the genetic alphabet for each cell of DNA.

Now she is trying to determine how this change or polymorphism evolves in the genes to understand how to salvage the receptors.

"If we could identify on which chromosome the genes — and there may be several — that cause Alzheimer's are located," said Poduslo, "we can start to make progress in understanding what causes the disease."

Both Poduslo and Freed understand the impact of Alzheimer's because they have seen it first hand. Freed lost his maternal grandmother to a dementing disease he believes was Alzheimer's. Poduslo lost her father.

Caregivers Find Solace

By Catherine Dunn

Alzheimer's disease attacks not just patients, but entire families.

Many families are not prepared to assume caregiver roles and often believe they have no one to turn to for the comfort and answers they need. But, they do.

Within the Texas Tech University Health Sciences Center, the answers and a friend wait in a small office called the Alzheimer's Disease Information and Referral Center (IRC).

Since 1985, the center, staffed by social worker Susan Reigel, M.S.W., has educated families on Alzheimer's disease, has offered information on other services and has provided free counseling, all in an effort to help Alzheimer's patients and the families who care for them.

"We provide free counseling here to work through the frustrations and concerns of caregivers and family members," Reigel said. "Alzheimer's is a very devastating disease. Many families go through a great deal of anguish because it is hard to watch the decline of their loved ones."

Many families cannot detect the disease in its early stages because they do not know the symptoms. They assume it is the result of "old age" when a family member begins asking questions repeatedly or has problems doing simple calculations. Often, the disease has progressed two years before a family contacts the IRC.

During a patient's initial evaluation, many family members find it difficult or painful to hear a doctor ask their loved ones simple questions they cannot answer, such as what day it is or who brought them to the clinic. For these families, the IRC provides a place where they can get information on the disease without watching the patient-doctor interaction. Family members also can voice concerns they do not wish to express in front of their loved ones.

"The best thing families can do is to educate themselves about the disease. Coping with Alzheimer's means getting ready for all types of changes that affect family lives," Reigel said. "Family members need to know how to deal with the changes because they can take a toll on the caregiver."

Eventually, families must cope with the patient's loss of short-term memory and of the ability to drive, communicate and perform simple everyday tasks such as bathing.

The most heartbreaking aspect of Alzheimer's disease is the stage when some patients no longer recognize their family members. For these families, sometimes, the best help Reigel can give is her time and attention.

"Basically, I try to be a friend to them when they need a friend," she said.

"It's really sad to watch someone with Alzheimer's," she said. "They seem to be perfectly healthy and yet they can't function at all. We couldn't help him. All we could do was just make him comfortable and try to get him what he wanted.

"The most frustrating thing about my father's illness, though, was seeing my mother deteriorate," Poduslo said. "She was the principal caregiver and it is hardest on the caregiver. My father really didn't have a clue he was sick."

Beyond the personal costs which are immeasurable, Alzheimer's will con-

tinue to have major economic cost on the nation's health care system, especially as the children of the baby boom approach retirement and become at risk for Alzheimer's. The disease remains, though, a significant challenge to researchers worldwide.

"In a lot of respects," said Freed, "Alzheimer's research is like hunting for a needle in a haystack. We know the needle is there and we want to find it, but we also need to be able to identify and sort the various types of grasses that were harvested to form that haystack." □

Pork Production Gaining Weight

By C. Louis Bischoff

On a farm in Plainview, pork producer Eddie Crum is striving to increase his farm's sow inventory from 500 to 800. Farther to the northwest, business leaders and city officials in Dalhart in May celebrated the ground-breaking of National Farms Inc.'s \$50 million swine-production facility.

Crum's farm and National Farm's 14,000-acre facility have a common bond. They both have been working with Texas Tech University's Institute for Pork Industry Research and Education about how they can best capitalize on the growing Texas pork industry.

The assistance from the pork industry institute, located within Texas Tech's College of Agricultural Sciences, is part of an ambitious project to bolster pork's impact on the Texas economy and give the nation's beef and poultry producers a run for their money.

Currently, a 450,000 pig inventory brings \$100 million in pork production revenue annually to the Texas economy. In contrast, more than 5 million head of cattle are fed in the region's feedlot industry alone. Beef production generates more than \$5 billion a year for the Texas economy.

"The Panhandle pork industry revenues should increase at least 30 percent in the next two years."

Institute Director John McGlone, Ph.D., speculates that the future of Texas is in pigs, as well as cattle. "The beef industry is established and not likely to expand much more," said McGlone, an associate professor of animal science and cell biology and anatomy. "This means we have more growth potential. The Panhandle pork industry revenues should increase at least 30 percent in the next two years. To meet the demand for pork in Texas, the industry would have to increase fivefold."

A major challenge for the institute is helping the state attract support and services for the producers. No major pork processing plants are in Texas, and the infrastructure is limited in providing producers with necessary equipment and services. Texas pork producers send their pigs to Mississippi, Iowa or California for processing. Comparatively, Panhandle cattle producers have at least 11 beef processing plants at their disposal.

The pork industry institute, which was established in January, is an outgrowth of pig research in the department of animal science. Since 1968, Texas Tech has received a \$200,000 annual line item from the state Legislature to enhance efficient pork production. McGlone joined the faculty in 1984. Four years later, the department received a \$15,000 grant to construct a demonstration pig feedlot adjacent to the university's livestock farm east of New Deal. The funding, along with \$36,000 from local sources, was provided by the Texas Diversification Matching Grants Program in an effort to help Texas diversify its agricultural industries.

Construction of the 240-pig research-oriented commercial feedlot was completed in the summer of 1990. Since then, faculty from the University of Saskatchewan and Iowa State University as well as USDA Scientists have planned similar facilities or have requested information on Texas Tech's swine

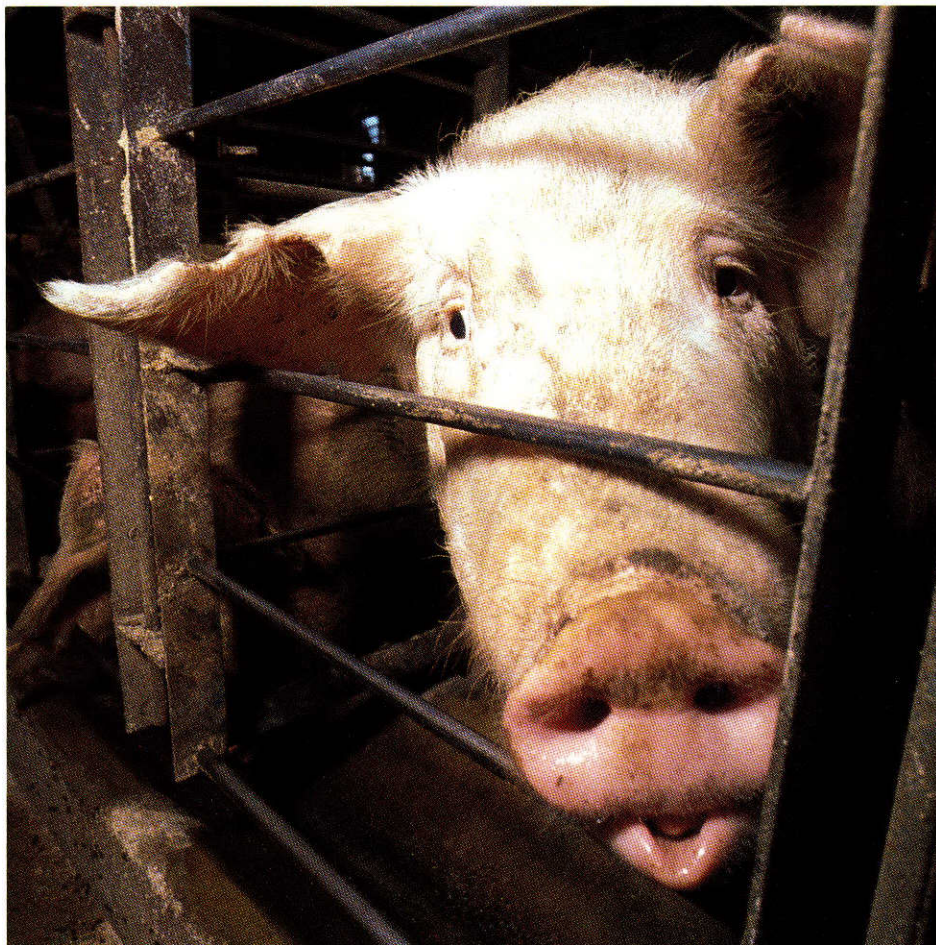


Photo by Artie Limmer

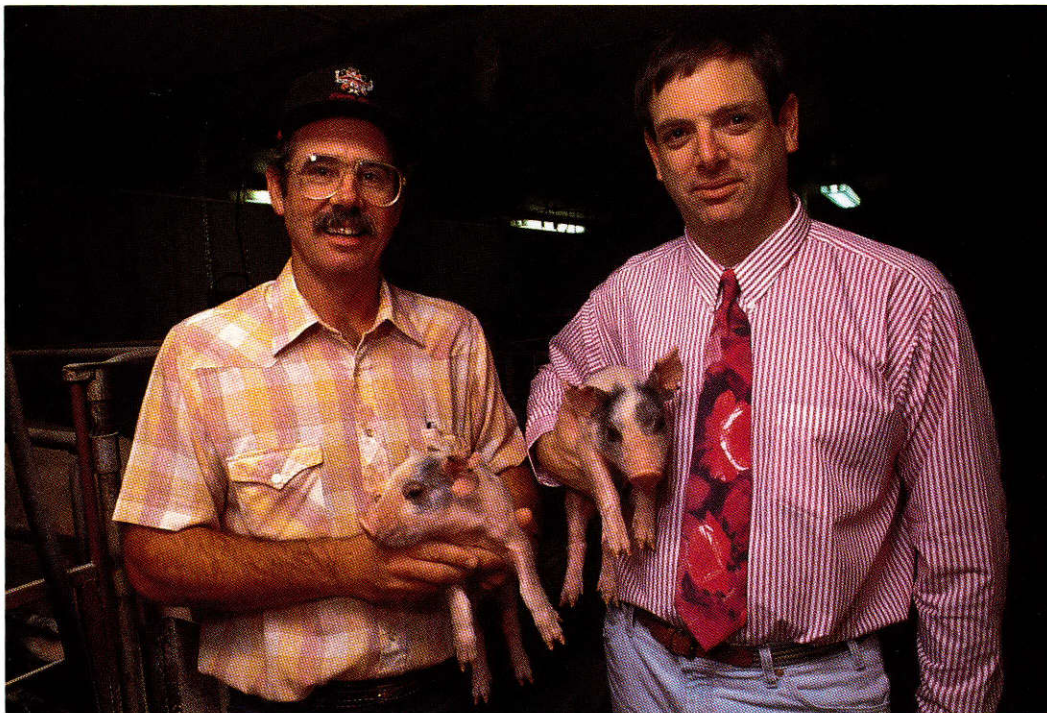


Photo by Artie Limmer

Jerry Smith (left) and John McGlone work to enhance efficient pork production.

research facilities.

Jerry Smith, the coordinator of pork industry education, said the institute's mission is twofold: to stimulate swine production and to encourage farmers already in other businesses to diversify.

For the swine facility near Dalhart, the institute provided a line of communication and information for Kansas City, Mo.-based National Farms, the Dalhart community, pork producers in the region and the Texas Department of Agriculture during the facility's planning stages.

"The Dalhart facility was an extremely positive thing," Smith said. "Approximately 300 people turned out for the ground-breaking ceremony. This has not happened in any other place in the United States because people have so many misconceptions about the pig business. Dalhart is like most rural communities in that it has suffered during the last 15 years. With farming being difficult, many local businesses have closed."

The Panhandle has natural advantages for pork production because of its dry climate, the amount of land available and the lack of anti-corporate farming laws, Smith said.

Anti-corporate legislation in several Central Plains states was intended to help the small-scale farmer stay in business, he said. "But, as a result of the

Kansas anti-corporate farming law, the state's pig inventory dropped 40 percent from 1980 to 1990. The pork packers left, and the infrastructure dissolved. Now the pork farmers are hurting, and their state legislature is back peddling. What they've realized is that a corporate farm keeps all area farmers competitive because the industry infrastructure remains intact."

Economic development studies and the applied research conducted by the department of animal science and the pork industry institute directly benefit pork producers and area farmers. "The dispersal of research findings from Texas Tech's pork research is very common. We are pursuing basic and applied research and their application to economic development," McGlone said.

Basic research on pig physiology and immunology is conducted through a collaborative effort with Texas Tech's Health Sciences Center. Janeen Salak, an animal science doctoral student, is compiling data on the effect that stress has on the swine natural killer cell, also known as NK, and the cell's ability to fight infection. Researchers use human leukemia cells as their test target. When the NK attacks a leukemia cell, a marker is released. The level of the marker that is released indicates how many of the leukemia cells were destroyed. The

immune system of an extremely stressed animal is less able to fight disease.

Future research will focus on hormones that are released into a pig's blood when stress is occurring, Salak said. Researchers will attempt to block the specific hormones that cause the stress response. "We now know that certain stress hormones will enhance the infection-fighting ability of NK cells," she said. Researchers speculate that the data will transfer to human immunology to help fight viral infections and diseases like cancer.

The New Deal facility has succeeded financially, becoming a major contributor to Texas Tech's livestock operations. It also has become increasingly important as a testing facility for companies such as National Farms and the National Pork Producers Council. These groups have funded comparative research on swine housing for cost efficiency and humane treatment, farrowing pen heat sources and pig feeders.

For example, data obtained from the comparison of various feeder types will provide quantitative information that help pork producers make sound decisions when they purchase equipment. "As equipment manufacturers introduce new concepts, Texas Tech acts as a sifting body. We evaluate equipment before it gets widely distributed,"

McGlone said, adding that many universities have moved away from applied research in favor of biotechnology. "Pork producers can find out what genetic engineering tools are available and what universities have learned in the laboratory, but they can't find out the best way to physically feed the pigs. Equipment manufacturers have discovered a whole range of missing information, and so they're funding applied research directly. There is a thirst for this information."

Researchers also are evaluating how various housing facilities affect the number of sows getting pregnant and litter size, how fast the piglets gain weight and how efficiently the piglets utilize feed. Pigs in each of the pen systems are videotaped, and their behavior is monitored. For instance, researchers are studying stereotypical behavior such as biting or gnawing the pen bars. Researchers want to determine the normalcy of the activity and decide how to interpret it.

Another focus is on labor intensive-ness. All swine-related maintenance is assessed for the ease of performance, or ergonomics, of the producer. This involves the design of work spaces and human-animal interaction to improve production, McGlone said. "This includes relatively subtle things such as walking among the pigs each day, or touching them instead of slapping them," he said.

Everyone in the pig business has to be concerned about the welfare of their animals, or the business is not going to

be profitable, Smith said.

"Adult sow housing is one of the main concerns of animal welfare activists. At the same time, it is a major cost for pork producers," McGlone said. "The general public is concerned, and pork producers want the public to be comfortable with the environments in which pigs are raised."

Smith cited a controversy in England, which centered on a ban of gestation and farrowing crates. As a result of public outcry, pork producers were mandated to change to a hut style pen that gives the sows freer movement when they give birth. At birth, a piglet weighs about 3.2 pounds while a full-grown sow weighs approximately 400 pounds. A litter averages 10 to 13 piglets. The farmer, as businessperson and humane steward, wants each of the piglets to survive. Because of the sows' wider range of movement in the hut-style pen, a piglet may inadvertently be crushed by a sow. Instead of a 10 percent death rate in the farrowing crates, deaths rose to 30 percent in the huts. The legislative change, Smith said, was based on an emotional level rather than on scientific research. "How can you be concerned about the welfare of the sow and not the piglets?" Smith asked. With fewer pigs surviving, food costs eventually will increase, he said.

Smith predicts that within five years, the Panhandle may have the necessary infrastructure to support pork producers. "As a result, demand will increase

Smith checks the feed level in a nursery pen.

for a skilled labor pool," he said. An internship program is being developed to help match students with local pork farmers who need labor and better trained people, Smith added.

Smith and McGlone approach their roles as allies to the pork industry from different perspectives.

McGlone escaped the New York City suburbs to study agriculture at Washington State University, where he earned a bachelor's degree in 1977. To finance his education, he worked in a campus job involving pig nutrition, reproduction and physiology. In 1981, he received a doctorate from the University of Illinois. He has been involved in pig research for 11 years.

After graduation with a bachelor's degree in agricultural education from Texas Tech in 1972, Smith worked as a production manager for DeKalb Swine Breeders. During his final six years with the company, he traveled throughout Latin America, Japan and China as a product salesperson and consultant.

"Because I didn't grow-up on a pig farm, I'm not limited in my vision of what I think could happen," McGlone said. "I'm likely to suggest things that are very unusual and don't occur to people raised in agriculture." Says Smith: "I'm just the opposite, I'm from the traditional agricultural background, the down-in-the-trenches part. Sometimes I'll say something, and he will question it. It really makes for some interesting discussions."

Smith and McGlone have no problem agreeing with the National Pork Producers Council's newest nationwide television campaign promoting pork as "the other white meat." According to the council, the fat content of a three-ounce serving of boneless loin roast dropped from 11.7 grams to 6.4 grams in the last decade. The calories within the same portion also were reduced from 208 to 160 during the same period.

"We're fighting the misconceptions that pork is unhealthy — that it has too many calories, too much fat and that it's not clean," Smith said. "Advancements in pork production have substantially improved the quality and safety of pork for the consumer. Better breeding and feeding have trimmed the fat, calories and cholesterol, making pork very competitive in price and nutrition with poultry." □



Photo by Artie Limmer

Consumer Complaints Wanted

By Jennifer LeNoir

What factors influence the purchasing decisions of consumers, and how does customer satisfaction come into play in the selection process?

These questions concern marketers everywhere, and at Texas Tech University they are the focus of research for Pam Kiecker, Ph.D., an assistant professor of marketing in the College of Business Administration.

Kiecker primarily has been involved since 1990 in the study of "complaint behavior" or the concern for service, quality and customer satisfaction. Her interest in the area came about from her own personal experiences as a consumer.

"I've basically had poor experiences where the personnel involved in delivering customer service have been ill-equipped, unprepared and basically disinterested. Too often employers put the lowest paid, least experienced personnel on the front lines. But they are

the ones who have customer contact so they need to be highly trained and paid more than minimum wage so they will be motivated about their jobs," she said.

"We are increasingly becoming a service-oriented society, but we have failed to deliver high quality service," said Kiecker.

High quality service is the basis for customer loyalty. Quality service functions as a public relations tool and often determines whether customers' word-of-mouth endorsements — or negative feedback — about a company will create goodwill with other customers.

"High quality service can actually be assigned a dollar value because it definitely can increase the equity of a firm. For example, companies often estimate their worth based upon the current

Pam Kiecker researches customer satisfaction and complaint behavior.

Photo by Artie Limmer



value of the property and the goodwill of a loyal customer base," she said.

Marketers looking to track the trends of the future can find a vital tool in learning how to accurately gauge consumer behavior and customer satisfaction. Several methods exist for measuring satisfaction levels, such as taking opinion surveys, using 800 telephone numbers for reporting customer satisfaction and simply asking the customers about their opinions related to shopping satisfaction.

Most importantly, Kiecker says, customers should be given the opportunity to "complain" about services or to give their personal assessment about satisfaction. People often complain to family and friends when they receive poor service, which, from a marketing perspective, does no good when the company cannot respond.

Instead, stores, shopping malls, airlines, restaurants and hotels should encourage seller-directed complaints, or complaints made directly to a company rather than to friends or family.

Kiecker, who earned her doctoral degree in business administration in 1988 from the University of Colorado at Boulder, has found through her research that complaint behavior depends on a customer's personality. For example, people with more assertive personalities often will be more likely to complain. Other characteristics of individuals who are likely to complain are high self-confidence, knowledge, expertise and education.

Another observation about complaint behavior involves the availability of the same product at numerous locations. For example, a customer who has several options about where to make a purchase is more likely to complain. As a result, customer satisfaction becomes even more important to those businesses, such as car dealerships or department stores, where there is a concentration of specific goods.

Improving customer satisfaction by encouraging seller-directed complaints is important today because future trends will greatly differ from present ones. Trends are important to marketers because, for some firms, they often pose threats to businesses' success in the marketplace. For other companies, changes in future trends help to open new markets and represent opportunities for further growth, Kiecker said.

Some of the major trends taking hold in the 1990s include an aging U.S. population that prefers geographically wide-open spaces in the Southwest or the option to live in smaller communities. More women are working outside the home; fewer babies are being born; more people are becoming millionaires; and individuals are striving for less stress in daily life. The 1990s will be a decade of "reverse materialism" when Americans realize they cannot have it all, and many will not want to have it all, Kiecker said.

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Quality of life will take precedence over lifestyle as more people will work freelance or part-time or take early retirement. During the 1990s, the largest, best-educated and most affluent consumers in history — the "baby boomer" generation (born between 1946 and 1964) — will move into their 40s and 50s, and marketers increasingly will focus more attention on the middle-aged, Kiecker said.

The median age in the United States will climb from 30 in 1980 to 36 in the mid-1990s and finally to 39 by the year 2000. With retirement on their minds, this segment of the population will join many of their long-living elders and leave a wide gap in the workforce — and in the marketplace — which the smaller "baby bust" generation or people born after 1964, will be hard-pressed to fill.

"As baby boomers move into top management positions, the dominant themes of the 1990s will be families, quality of life and high work productiv-

ity. The trend will foster a back-to-basics attitude — a period of rest after the fast-paced, high-spending 1980s," she said.

Younger baby boomers' living standards may never reach those of individuals born before 1955 — many of whom got good jobs early and bought homes before prices began to escalate. Baby boomers' greatest worry will be housing costs.

Additionally, middle-aged individuals already are competing hard for promotions in a world of shrinking opportunities. Dim prospects will drive some workers to smaller companies or to their own businesses. This group will be more prone to career-switching as they look for work with more social purpose or with freer time to spend with their children. Employers will be more pressured to provide flexibility on the job for people, especially for their talented workers, Kiecker said.

A rapid growth in the numbers of minorities and immigrants will occur by the year 2000. Of the under 30 population, 40 percent will be minorities, making them a core market rather than a marketing afterthought. Hispanics, which currently represent 8 percent of Americans, may become the largest ethnic minority, surpassing blacks shortly after the turn of the century.

While some of these predictions are insightful readings of culture and consumer change, Kiecker notes, some are sheer speculation. But for marketers looking to track the trends of the future, many predictions about the 1990s and the year 2000 may be a source of inspiration.

"As a result of the impending changes in the economy and population trends as a whole, businesses interested in being successful will need to satisfy customers' needs and wants more than ever. And the best way to do that is by providing high quality service," she said.

"While dissatisfied customers may often boycott specific businesses, often resulting in the loss of only one customer, the overall probable result is that they will tell all of their friends about the poor customer service. Thus, with the marketplace already becoming so increasingly competitive, companies cannot afford to alienate any single customer if they are to successfully survive the marketplace of the 1990s." □

The Burden of Mathematics Anxiety

By Nina L. Ronshausen, Ed.D.

(Editor's Note: The following opinion piece was written by Nina L. Ronshausen, Ed.D., associate professor in the curriculum and instruction division of the College of Education. Her expertise is in mathematics and in mathematics education for prospective elementary education teachers.)



Photo by Artie Limmer

Mathematics anxiety can devastate lives. Good preparation in mathematics is recognized as the critical gateway to good-paying, prestigious jobs in today's technological workplace. Yet even moderate levels of mathematics anxiety can lead to poor decisions about further education and careers.

Students who exhibit high levels of mathematics anxiety tend to have low levels of mathematics achievement and low levels of confidence in their abilities to learn mathematics.

"I walked into the class and sat down. The teacher started talking and I don't think I even heard him. I just kept saying in my head I can't do this, I can't learn math. That's how I felt when I started college algebra. It never got much better."

That's how a female graduate student recalled her introduction to college mathematics. Early in her life, perhaps before she completed junior high school, she opted for math avoidance: the fewest and easiest mathematics courses that fulfilled requirements, a career that required only basic arithmetic skills. Without realizing it, she also limited her choices to low-pay, low-status careers.

Like so many others, the graduate student knew she was trapped by her poor preparation in mathematics. She blamed her situation on inability to learn or understand mathematics. Her real problem was severe mathematics anxiety.

Mathematics anxiety is a universal experience. Even those of us who are not ordinarily anxious have known it. College students in advanced mathematics

courses, graduate students in mathematics-dependent fields such as engineering and the sciences, people who use mathematics regularly in their

jobs — all have been found to have some mathematics anxiety, in some situations. The question isn't who but how young, how often, how bad and what provokes mathematics anxiety?

Symptoms of mathematics anxiety vary greatly. A mild attack may seem like uneasiness, butterflies in the tummy, or a heightened awareness. Experienced learners/users of mathematics may welcome the feeling, likening it to the anticipation of a singer or athlete who is "sharp" for an imminent performance.

For everyone else, mathematics anxiety is a burden. Dread and a desire to flee are, all too often, accompanied by physical symptoms. Symptoms may vary from nervousness, flushed skin and physical awkwardness to very noticeable pallor, uncontrollable shaking, nausea and vomiting, narrowed vision, decreased hearing, loss of visual and/or auditory memory, stuttering or other dysfunctional speech, or inability to sleep.

Severely afflicted persons report inability to read mathematics materials, inability to make decisions and inability to sequence tasks; some say they literally feel paralyzed. One student, confronted with a "pop" quiz, said later that she felt frozen in her chair, unable to decide what to do or even to identify alternative behaviors, and, for a short time, unable to decide where she was.

What demands on an ordinary human being in an ordinary classroom or workplace could produce such effects, which are themselves frightening to the person who experiences them?

Studies of mathematics anxiety have identified three components. The components relate to triggers of mathematics anxiety, that is, to sources of concern to the learner/user of mathematics.

One component of mathematics anxiety is abstraction anxiety. The learner/user has difficulty coping with concepts, the vocabulary associated with concepts, and the arcane statements about concepts which constitute definitions, axioms and theorems. The hierarchical nature of mathematics and the

emphasis on precision and on logic are aspects of abstraction anxiety, as is the combination of creativity with cunning selection of strategies, knowledge and skills that is required for problem solving. All too often, the learner/user comes to believe that mathematics is all abstraction and is unable to appreciate (much less devise) helpful real-world examples of the abstractions encountered.

A second component is computation anxiety. The learner/user finds it difficult to apply his or her existing knowledge and skills to learn more mathematics, or to perform everyday tasks or job-related tasks. Teachers encounter this component frequently in the form of the comment, "I don't know where to start." Learners may be unable to perform the same behaviors, in the same sequence just modeled by the teacher.

Employers are all too familiar with the condition, as they hire recent graduates with decent GPAs and mathematics credits and then must provide extensive on-the-job training in rather basic mathematics as well as in job-specific applications. Employers of engineering graduates are as likely as employers of bank tellers, salespersons, or insurance paper processors to learn the necessity for workplace-schools.

The third and most burdensome component of mathematics should be labeled performance anxiety. Tests and quizzes do provoke mathematics anxiety, but so does any situation in which one is expected to perform more or less publicly. Oral questions by the teacher, working at the chalkboard, team games, homework or projects to be turned in for a grade, a report to one's boss — all are major contributors to mathematics anxiety.

Primary school boys and girls have comparable levels of mathematics achievement as well as positive attitudes about mathematics. As late as fourth grade, there are no significant differences in achievement between girls and boys, while both groups select mathematics as their first- or second-favorite school subject.

The situation is quite different by the end of the middle school years. By then, girls tend to have lower achievement levels and less positive attitudes toward mathematics than boys have. Among high school children, males

achieve higher than females on mathematics application tasks, even when the two groups have successfully completed comparable mathematics courses. In the few instances in which females out-perform males, the mathematics tasks are low-level (such as computation).

The gender differences in achievement are accompanied by gender differences in measures of attitude, confidence and mathematics anxiety. Persons with high mathematics anxiety, and most females fit this description, tend to have low achievement, poor attitudes and little confidence in their ability to learn or do mathematics tasks. These students have fewer interactions with their mathematics teachers, and they tend to believe that their parents have poorer perceptions of them as learners of mathematics.

The level of confidence affects the likelihood that a female will attempt a mathematics task, the extent of her efforts to complete the task, and the persistence of her efforts when she encounters difficulty with the task. A high-confidence female will attempt alternative procedures but a female with low confidence is likely to stop when her first effort fails.

High-confidence learners tend to overestimate their ability to learn mathematics, particularly problem solving skills. Even though inaccurate, the self-perception may increase persistence when tackling difficult mathematics tasks.

When females and males encounter mathematics learning difficulties, they differ in the causes to which they attribute their difficulties. While males tend to place blame on external sources, females tend to place blame on internal sources. High school and college males who just earned a low grade on a mathematics test were reported as saying the following:

I should have studied more.

It's been a year since my last math course.

My friend said I can study with him until I catch up.

The teacher didn't explain that very well.

This is the first exam. You have to find out what the teacher expects.

Well, it's luck — you win some, you lose some.

Females who had difficulty with the

same tests said:

I never was any good at math.

I really don't like math.

My mom and dad say they weren't good at math either, so I inherited it, I guess.

I just don't get it.

I just get so nervous, I can't think.

I work hard, but it doesn't do any good. I'm just a hopeless case.

One consequence of these perceptions is that male students tend to believe their difficulties are remediable, and they take action. Females tend to believe that their situation is permanent.

No one has found a cure for mathematics anxiety. Several treatment methods have proved beneficial; that is, treatment leads to lower levels of mathematics anxiety and higher levels of mathematics achievement.

The best treatment of mathematics anxiety is: higher levels of mathematics achievement over a long period of time. A proved record of performance is a tonic for low confidence, poor attitude and high anxiety. Obviously, there is a Catch 22, in that mathematics anxiety tends to interfere with mathematics learning.

Treatment programs that focus only on reduction or elimination of mathematics anxiety have not been particularly helpful. The more effective treatments emphasize "damage control." Damage control means developing coping skills; that is, limiting the effects of mathematics anxiety. Successful programs often include individualized diagnosis and remediation of mathematics knowledge and skills, along with attention to coping skills.

One of the more unusual treatment programs trains participants to interrupt the physical symptoms of anxiety through use of relaxation techniques. When the physical symptoms decrease, there seems to be less mathematics anxiety, as well.

Helpful behaviors taught in other successful programs may involve the participants' mathematics teachers. For example, teachers can be trained to plan for a session of relaxation techniques in the classroom prior to each examination or quiz.

Teachers can break examinations into sections, administering one part at a time. It can be helpful to administer examinations orally rather than in written form; to give feedback one exercise

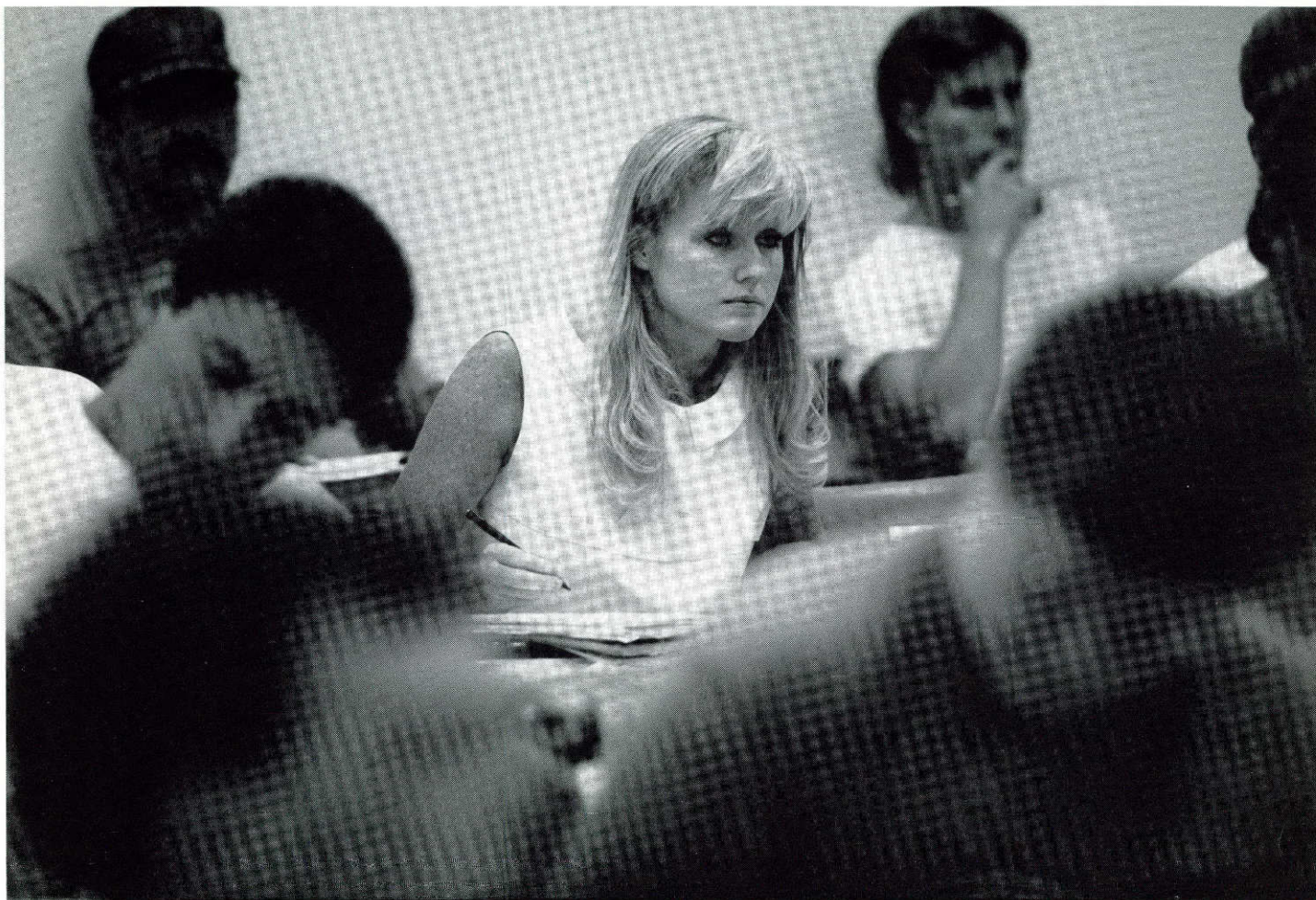


Photo by Artie Limmer

at a time rather than after the exam is completed; to allow one or more retakes of the exam. Some students are helped enormously when the teacher allows them to take examinations privately rather than seated among the entire class. One of the best forms of assistance is removal of time limits on exams and quizzes.

Other successful treatment programs include individual or group counseling. As with so many problems, it can be beneficial to learn that many other people have similar difficulties and to share information about effective coping strategies. Some individual and group programs emphasize development of self-esteem by identifying and rewarding participants' strengths, or by developing and implementing a series of graded exposures to anxiety-producing situations.

Still other treatment programs employ vicarious learning (providing

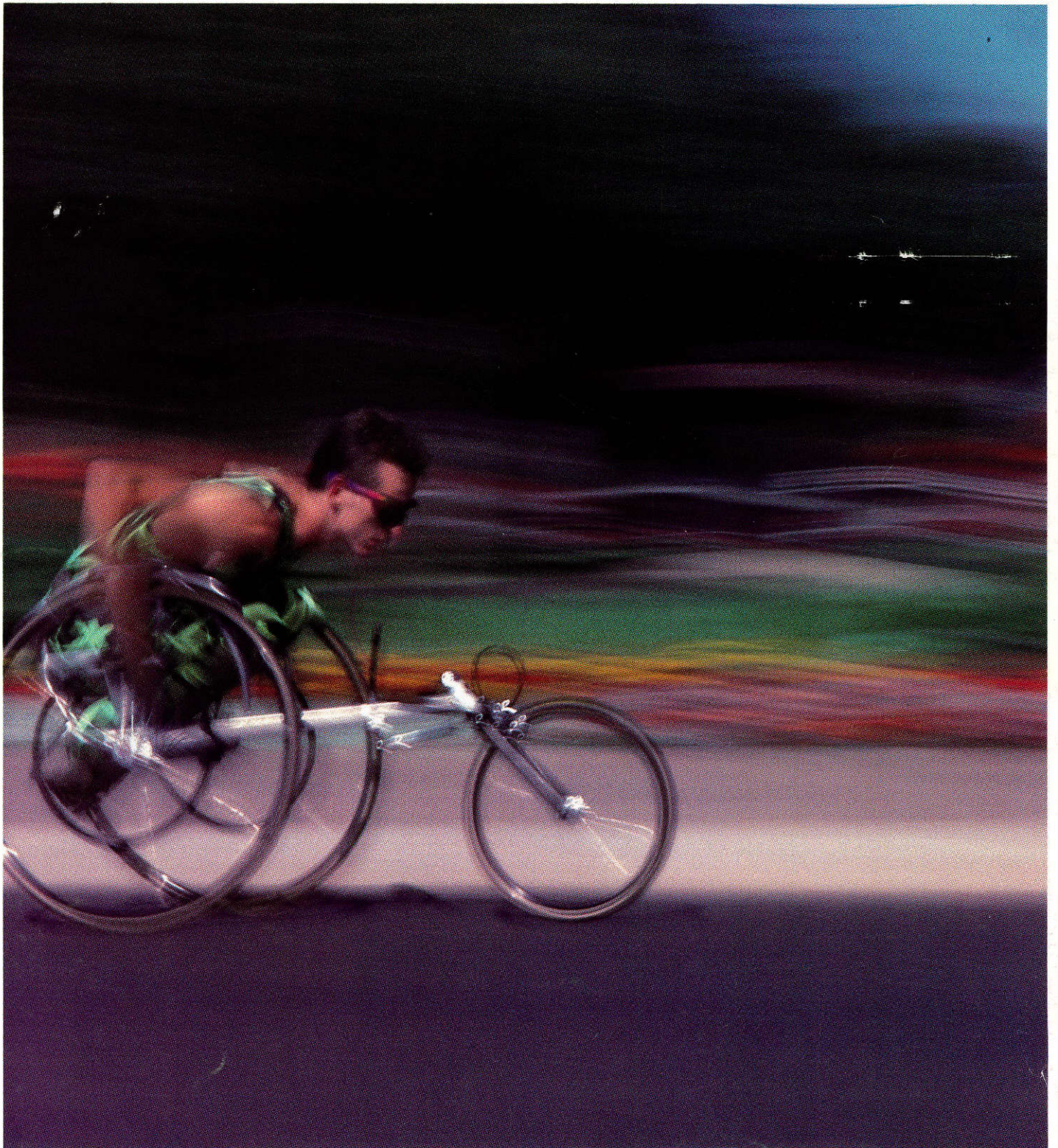
female role models as guest speakers or mentors who provide information about their own strategies for coping with mathematics anxiety, and the value of mathematics in the workplace), and other means of providing career information.

The junior high years seem to be the crucial time for female students in selecting or avoiding mathematics-dependent careers. Hence, more and more treatment programs designed for 11- to 15-year-old females are becoming available.

Since one of the best ways to control mathematics anxiety is to limit its development in the first place, and because high achievers tend to have low mathematics anxiety, we should expect and reward good mathematics teaching. Perhaps our best teachers, and particularly our best female teachers, should be assigned to our junior high schools.

By the end of the middle school years, girls begin to have lower levels of confidence in mastering mathematics skills than boys have.

As women demand and earn opportunities to enter previously male-dominated professions, and to work at more responsible and more rewarding levels, and as our society is increasingly technology-dependent, the need for better education in mathematics grows. Every parent, every teacher, every person who cares about our future and the contributions women will make, should be concerned for the negative effects of mathematics anxiety on our female students. There are solutions which can be implemented at relatively little expense in our schools and through existing programs for girls, such as scouting. We are paying a greater cost when we do not deal with mathematics anxiety. □



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