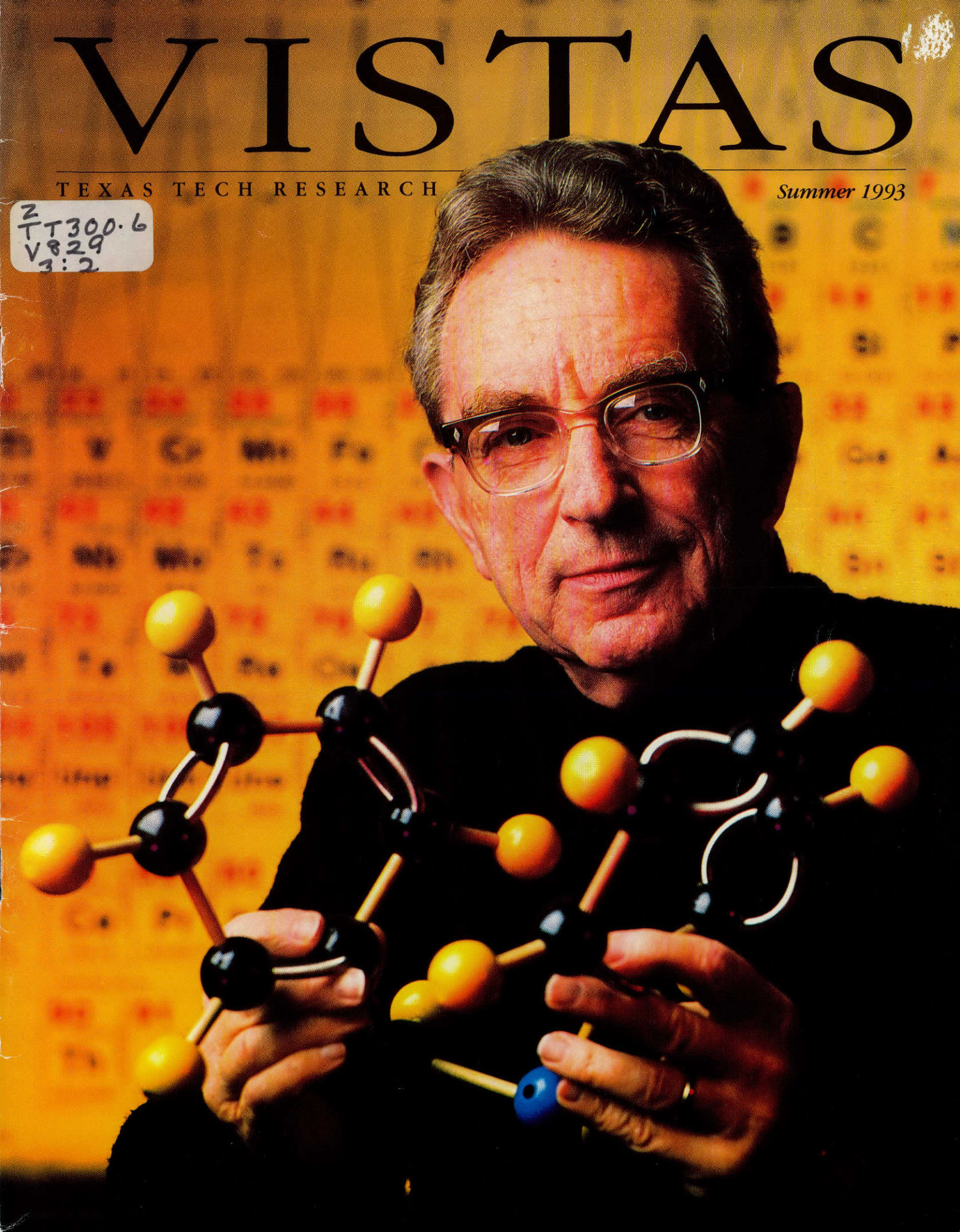
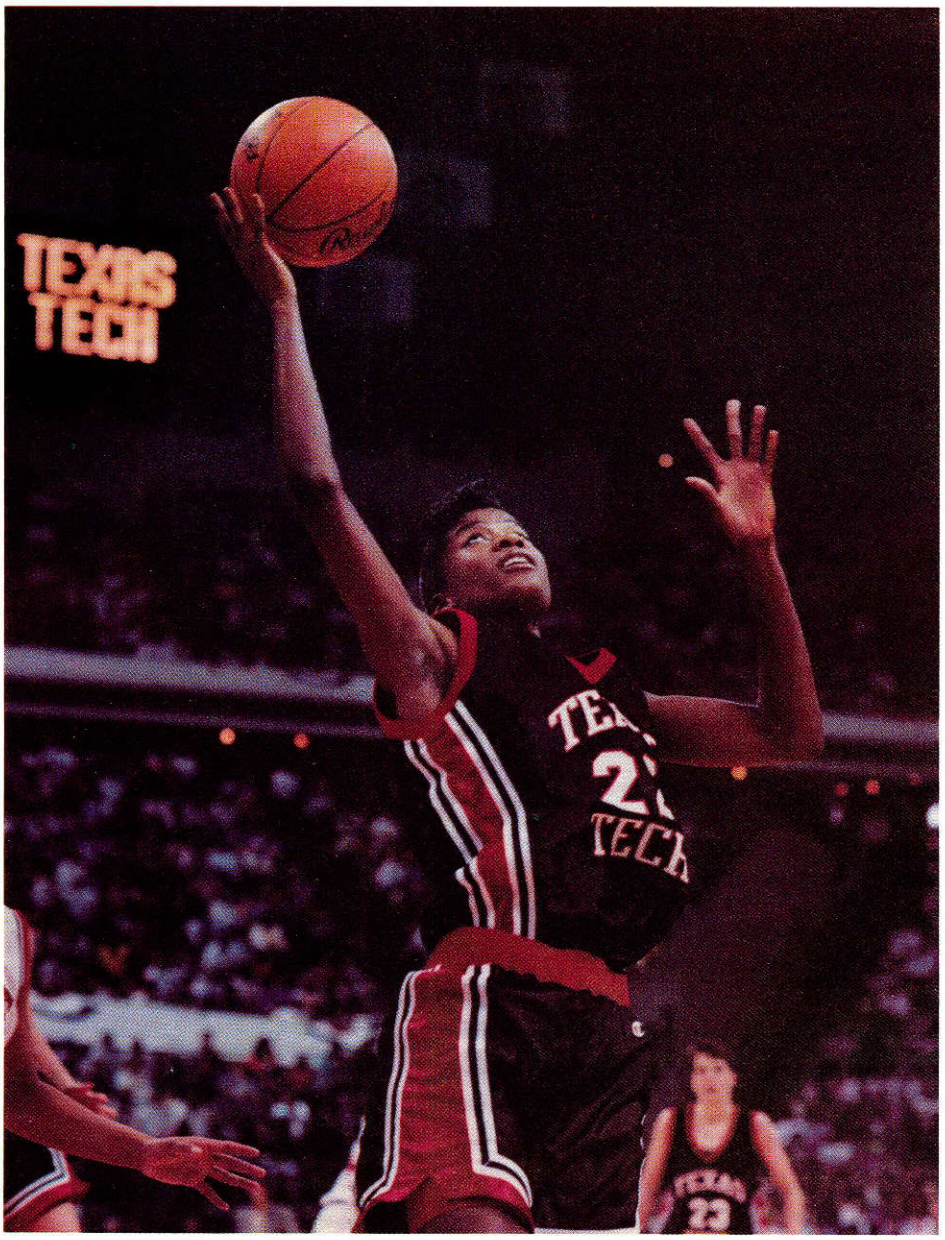
VISTAS

TEXAS TECH RESEARCH

Summer 1993





ABOUT THE COVERS

Front—Horn Professor Henry J. Shine reached a researcher's pinnacle when he unexpectedly discovered a new branch of organic chemistry, cation radical chemistry. His revelation happened while he was answering questions about another chemical phenomenon, the benzidine rearrangement, once considered to be the ultimate find in the discipline. (Photo by Artie Limmer)

Inside Front—The NCAA Division I Player of the Year in 1993, Texas Tech's Sheryl Swoopes, surpassed record after record in women's basketball, prompting many sports analysts to identify her as the best women's basketball player ever. By the time the game buzzer marked the victory of the Lady Raiders in the NCAA National Championship, Swoopes had scored 78 points in the two games of the Final Four showdown and set 10 NCAA Tournament records and tied two others. (Photo by Sharon Steinman, The University Daily)

Back—Texas Tech women's basketball Coach Marsha Sharp took her team to the NCAA National Championship, bringing back the first national championship title in the university's history. Led by seniors (left to right) Krista Kirkland, Sheryl Swoopes and Cynthia Klinger, the Lady Raiders defeated Ohio State University 84-82 in Atlanta to complete their mission. (Photo by Sharon Steinman, The University Daily)

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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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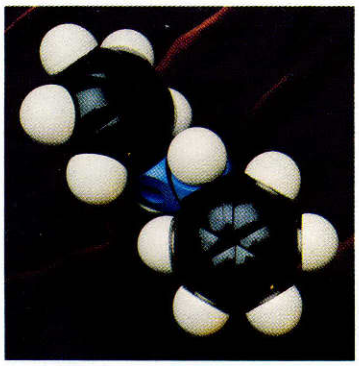

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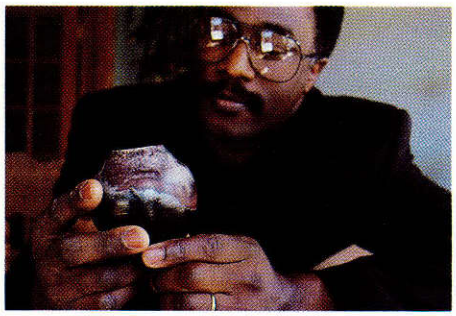

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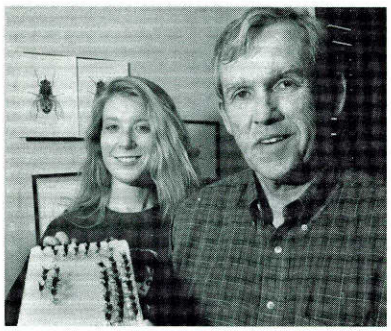

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Helping Students Through the Starting Gate

More than 20 years ago, industry and university leaders realized they had a problem attracting minorities to the engineering pipeline. Programs were started to recruit minorities to universities, however recruitment alone did not solve the problem; many first-year minority engineering students did not graduate. So universities started focusing on retention as the key in assisting minorities to become engineers.

At Texas Tech University, the Minority Engineering Program (MEP) was started in 1989 to encourage Black, Hispanic and American Indian students to excel and graduate. Admittedly a newcomer to minority retention, the program has only in the last year started to gauge its results. Compared to other universities, Texas Tech falls slightly behind the national average in the number of minority students that graduate in colleges of engineering: 6.3 percent of minorities in Texas Tech's College of Engineering complete their studies. The national average is 7.7 percent. Hired last year, MEP's full-time director Stephanie G. Adams plans to improve the university's statistics by borrowing and adapting ideas and strategies from other successful programs in an effort to help Texas Tech's minorities leap out of the starting gate.

In Adams' office are descriptions of minority retention programs, such as the Mathematics, Engineering, Science Achievement (MESA) program at the University of California-Berkeley and Graduate Engineering for Minorities (GEM) program at Notre Dame, which have successfully increased those universities' minority graduation rates as much as 66 percent. Those programs are successful because they have identified the obstacles minority students face, such as a lack of elementary and secondary school preparation, poor advice from college advisers and a lack of role models. Adams said these same problems hold back minorities who enroll at Texas Tech.

When looking at the problem of poor elementary and secondary school preparation, Adams said many things can be done by MEP before a minority student enrolls in the university. "Some high schools teach calculus while others don't. But the college doesn't consider that a student didn't get calculus," said Adams. "It looks at a student and says, 'You're here and I'm teaching college calculus and you should be ready for it. If you're not ready for it, too bad.' What we have found is that most minority students haven't come to Texas Tech prepared."

If they miss an introductory class in high school, most minority students will start behind in their college work and often cannot catch up. If they must take trigonometry as a freshman they cannot take Calculus I for an entire year, so minorities often start out a year behind other engineering students. "Kids get discouraged because they have taken all these classes and still see that they are not getting into engineering, so they decide to quit and do something else," said Adams.

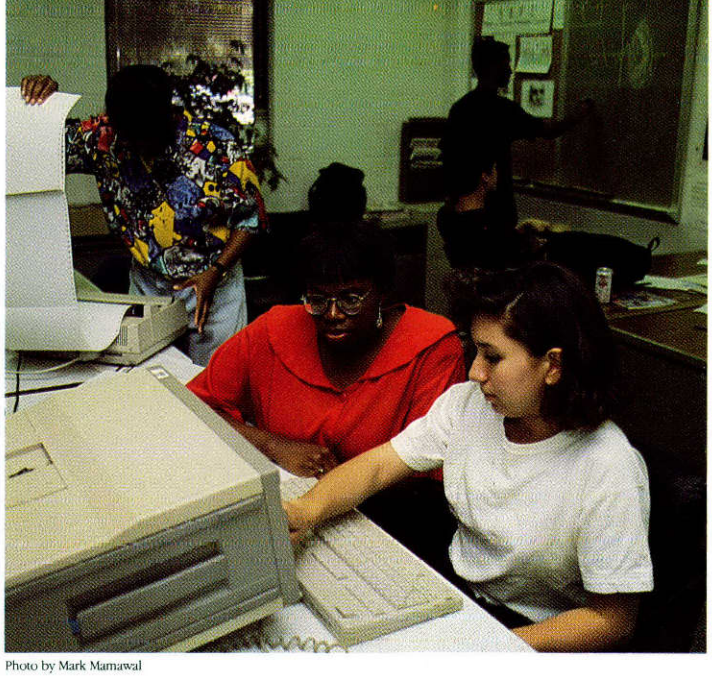


Photo by Mark Mamawal

Minority engineering students collaborate toward graduation.

She is working now to convince high schools to ensure that minorities receive a suitable pre-engineering education — including encouraging students to study math and the hard sciences — before they come to Texas Tech.

To improve the odds that a minority student will receive proper training, Texas Tech's MEP also is cultivating future minority engineering students beginning in the junior high school grades. This summer, the college will bring eighth and ninth grade minority students together for The Summer Institute at Texas Tech, a four-week residential science and engineering camp.

Once minority students arrive at the university, MEP strives to put them on solid footing as freshmen and into the first semester of their sophomore year. Texas Tech's program does that with a week-long summer "boot camp" at the university's Junction campus that takes incoming freshmen and teaches them basic study skills. "We give them preparatory skills, study skills and advice on what they can expect. It's a tough week, but it improves their attitude and helps them face the challenge they're up against," Adams said.

Students who have attended the camp find they have a safety net of study and organizational skills to fall back on. Erika Martinez, a sophomore from Odessa, went to Junction as a student and then returned to Texas Tech as a MEP counselor. "As a student, it really helped a lot. We had classes in study skills and note taking, and we met the professors we were going to be working with," said Martinez. "I wanted to be a counselor to pass on to incoming freshmen the idea that college is different from high school and that it's not all freedom. Hopefully, I can help them realize that they do need to study."

During the semester, the MEP clusters sophomore and junior minority engineering students with freshmen, so that they work as a team and help each other, plus the older students pass on their experience to the younger students. "What we're trying to do is get people in an environment where they feel like they belong, much like a community or a family," said Adams. "The students study together, go to movies together and begin to help

each other so they can stand on their own. By the students' performance and attitude we can gauge it is working."

This clustering goes a long way toward giving a minority student the confidence to succeed. "For me it's kind of like an anchor. Otherwise I could end up floating through university life with no base to work off of. It provides a sense of security," said Jess Miramontes, a sophomore from Pecos.

As MEP strives to help more minorities to achieve, a minority engineering advisory board has been formed to develop strategies that will give minority students the resources and motivation they need to prepare for careers in engineering. From this has come financial support: Amoco, Exxon, Arco, GTE and Texas Instruments all have donated money to the College of Engineering in an effort to improve the odds of graduating minorities.

The industry support then is taken one step further by Adams, who believes that once minority engineering students complete their sophomore year they have a better chance of graduating. Texas Tech's program continues to encourage minorities by introducing them to role models. Adams has started a professional development series, where the college brings in engineers from the companies that have supported the minority engineering program in the past. "The message is that not only have these professionals gotten through school, they also have succeeded in the work force, and this is what the work force offers you," said Adams.

— Michael Sommermeyer

A New Name for the Future in Agriculture

When the Texas Tech University College of Agricultural Sciences first opened its doors in 1925, it was devoted to helping farmers and ranchers with the problems they faced in growing crops and cattle. And the college lived up to its mission: to help create on the Texas High Plains the largest cotton growing region in the United States.

Donald E. Green, in his book "A History of Texas Tech University's College of Agricultural Sciences, 1925-1975," writes, that in the first few years after the establishment of the college, "Farmers found that the agricultural staff was readily accessible . . . no reasonable request for service was turned down."

As the questions grew more complicated, the college grew more knowledgeable. Today the emphasis on agricultural science has expanded to include biotechnology, range and wildlife studies, landscape architecture, agricultural education and agri-business. To reflect that diversity, the Texas Tech Board of Regents recently approved the renaming of the College of Agricultural Sciences to the College of Agricultural Sciences and Natural Resources.

As the college prepares for the 21st century, students and faculty are involved in many projects such as studying the pricing structure of cotton; mapping the DNA of cloned cattle; tracking the movement of mule deer in the Trans Pecos; designing national monument visitor sites; and researching the manipulation of DNA to grow drought and heat resistant crop plants.

Dean Sam Curl explains that the name change not only allows the college to recognize the existence and strength of its range science, wildlife science, fisheries science, soil science and landscape architecture programs, but the change also permits the college to generate more research grants and contracts.

"It is essential that prospective students, parents, high school counselors, granting agencies and other representatives of the general public recognize that we have a strong orientation in the scientific aspects of both agriculture and natural resources management and conservation," he said.

In embracing the future, the college has expanded its role to solve environmental problems and to help humans make better use of their natural resources. However the college has not lost site of its original mission to further the development of agriculture, Curl said.

— Michael Sommermeyer

The Evolution of a College

To signify the evolution that has taken place in the field of home economics, Texas Tech University recently dedicated the College of Human Sciences. The new name better identifies the former College of Home Economics, which has been a part of academic life at the university since its beginning almost 70 years ago.

"Our goal is to maintain our strong programs under a new title and to sustain the broad scope of current research being conducted in the college without losing the sense of pride in our heritage," said Elizabeth G. Haley, dean of the college.

The college continues to provide educational programs that focus on individuals and families and their relationships with their social, psychological, economic, physical and aesthetic environments.

The college's research thrust has expanded with the faculty acquiring more than $2.85 million in sponsored project grants for fiscal year 1992. For the past 10 years, the college has averaged more than $2 million annually in grants.

Currently researchers are studying such topics as those related to textiles, new industries in the state, eldercare and child care, nutritional assessments, parenthood, remarriage, child abuse, adolescent risk-taking, family finances and addiction issues.

The college's service-oriented curriculum center produces and disseminates home economics teaching materials for use in secondary and post-secondary home economics programs. Also, a hands-on training facility provides work experiences for hospitality students.

Just as Texas Tech has grown from a small regional college established to "teach liberal arts, household economics, agriculture and engineering" into a national research university, the former College of Home Economics has enjoyed its own growth of its academic, research and outreach programs.

— Myrna Whitehead

The Imprints of Time

Thomas Cadwaleder Jones' great-grandfather was a Confederate prisoner of war who died in 1865 in the Alton Prison, a horrid Union penitentiary located in southern Illinois during the Civil War. That personal connection to history has impelled Jones, a playwright, to explore in his works contemporary issues of race and war.

His newest play, "Scars and Stripes," involves two young people — a black urban girl and a white rural boy — who meet at the Vietnam Veterans Memorial in Washington, D.C. At that haunting and healing black wall, the two teen-agers confront their racial prejudices while they are searching for evidence of their fathers' pasts. Through the experience the characters, Jewell Robinson and P.T. Flagg, discover more about themselves and each other, finally sharing their common humanity.

In the play, Jewell, a black teen-ager from New York City, is determined to prove that she does not need anybody's help, especially help from P.T., a white youth her own age from rural Arkansas. P.T. has arrived at the monument to search for his father's name, never expecting to meet someone "like her." The two begin to realize the similarities that draw them together as they break down the walls of prejudice and stereotypes that exist between them.

Jones' play has evolved into an educational vehicle, especially for youth, to discuss openly those often painful issues of living in a diverse and sometimes oppressive America. After the 65-minute production, the audience is invited to participate in a discussion examining issues found in the play, such as the complexity of racism, personal and societal prejudices, regional stereotypes, cultural identity and acceptance of difference.

Jones is head of the playwriting program at Texas Tech University, where he also is associate chair and director of graduate studies in theater arts. He earned his Ph.D. in dramatic art at the University of Iowa and is a member of the Dramatist Guild.

Having never before written a children's play, Jones said his current work is easily accessible to young students and may have a more affirmative impact on them than on an adult audience.

"The sad thing is that by the time people become adults, it's almost too late for attitude changes," Jones said. "Diversity is a success strategy for kids. It's a different world than what their parents lived in. The only way that we're going to have a successful future is to embrace diversity, understand it and learn to live with it as a positive thing."

"Scars and Stripes" premiered Jan. 19 on Martin Luther King Jr. Day at the Louisville Gardens stage. Among the largest professional children's theaters in America, Stage One of Louisville, Ky., funded the effort. The play toured throughout February during Black History Month as part of Stage One's theater-in-education program.

"The play is more complex than just black and white. I think the idea is that if you can get beyond initial prejudices, then maybe you can build a friendship that is stronger than it would have been otherwise because you're trying to look into each other's being rather than just looking at each other," Jones said. "The idea is really to get the kids to think about reaching out, like Jewell and P.T. do at the end of the play, to someone they ordinarily would not have reached out to, to maybe want to find out something about them."

The two acquaintances find they share in common a history of abuse, a socially pervasive experience that knows no racial or gender bounds, Jones said.

"I guess the 'Scars' aspect of the title seemed appropriate because of the element of abuse. 'Stripes' also are a form of abuse. Scars are what are left after something heals," he said. "If there is a kind of awfulness when people meet, and they do initially hate each other just

Exploring issues of race and war in his most recent play, "Scars and Stripes," Thomas Cadwaleder Jones hopes to affect the young.

Photo by Artie Limmer

because they're different, then that's the gash, the stripe that is left. If they get beyond that, as these two kids do in the play, then it becomes a scar."

The Vietnam Veterans Memorial itself is like a scar, a place of healing, and seemed to be the germane setting for the play, Jones said, noting that the wall is forever marked by the thousands of names chiseled there.

"The black marble structure of that memorial is a reflective surface so that as you look at it you see people reflected there with you. It seems that every kind of face imaginable is reflected, and when I was there I could see my own reflection among all those other faces. I remember thinking that this is really America because when you're reflected like that in the black, you don't see color. You just see faces and you know those faces represent all different races, ages, sexes and beliefs of every kind," he said.

Jones first visited the Vietnam Veterans Memorial in 1984, and although he never knew anyone killed or missing in the war, he found the encounter to be powerful. In graduate school during the Vietnam War, Jones never was drafted, "just by luck or fate," unlike his great-grandfather who was conscripted into the Civil War.

Jones' intimacy with war came when he acquired a series of 13 yellowed letters written during the war between North and South by his great-grandfather to his great-grandmother. Henry Bennet Jones, born in Kentucky about 1830, was a farmer who later moved to Arkansas and reared a family of five children before joining the Confederate army.

During a genealogical journey to Alton, Ill., in the summer of 1988, Jones, his wife and one of his daughters found an obelisk, a memorial to the 1,000 or so Confederate dead who perished during a smallpox epidemic at Alton Prison. Upon finding the name of his great-grandfather, Jones and his own family were touched with tears. "To me, as I stood and stared, the monument seemed to pierce the heavens in a kind of grim, silent protest," he said.

"In many ways, a playscript is a family history. It is both a record and a prediction, partially real, partly invented. Characters in plays often seek to discover from where they came; and, as it turned out, so did I," he said.

Another somber monument, the Vietnam Veterans Memorial has been the scene for three of Jones' earlier plays: "A Circle on the Cross," which premiered Off-Broadway at The Open Eye in New York; "Scarred Ground," which debuted at Victory Gardens Theater in Chicago; and "The Wall Inside," which was produced at Texas Tech in the New Plays Production Program and also received its professional premiere at The Open Eye.

"In the plays I have written, I have always tried to get at some kind of significant and universal truth," Jones said.

His newest play, "Scars and Stripes," hopefully will convey to some that when we see other people as individuals — as real human beings — then we have to rethink our prejudiced thoughts, beliefs and fears.

— Kippra D. Hopper

Holistic Designs and Saving Energy

To design an energy-efficient building, architects have to look at the entire building as a whole system rather than at its individual components, says Glenn Hill, a Texas Tech University architecture associate professor.

Since 1984 Hill has focused his work on energy-efficient buildings and specifically on solar-assisted structures.

"When we talk about energy-efficient buildings, many times we're talking about the building construction, heating, lighting and air conditioning as separate components," Hill said. "But if you integrate the three, you can produce a more energy-efficient building."

Hill said several projects involving the design and building of active and passive solar-assisted homes with local developer and builder Henry Huneke revealed the need for more effective integration of building and energy systems and the advantage in looking at the design of buildings more holistically.

Hill and Huneke found that they could design a cost-effective and energy-efficient home utilizing energy conservation and passive solar energy. Compared to a conventional home, depending on the homeowner's energy usage patterns, 60 to 75 percent savings could be generated through the use of passive solar energy, Hill said.

Passive solar systems use natural means to achieve a similar result such as placing a window on the south side of a room to allow sunlight to flow freely through the pane and warm the space. Active systems utilize mechanical means to collect and transfer energy through devices such as pumps, Hill explained.

Since those early projects, Hill has continued his search for a more holistic approach to the design of architecture and better integration of energy issues into buildings in his work at the university.

Hill and Mark Spitzglas, Ph.D., former associate professor of architecture at Texas Tech, recently completed the first phase of research that focuses on energy efficiency in commercial buildings utilizing a "dynamic envelope" principle. Dynamic envelope refers to the "skin" of a building being able to heat or cool depending on the temperature outdoors.

With a four-year grant of $200,000, funded by the Energy Research Application Program of the Texas Higher Education Coordinating Board, the statewide project is examining energy usage in mid-rise commercial office buildings in three cities — Houston, Dallas and Lubbock — and is seeking ways to reduce non-renewable energy usage through architectural, rather than mechanical, means such as daylighting and building design.

The research has affirmed that the principal energy usage in the office buildings is lighting and cooling and that a dynamic link exists between the two. Because of the high lighting requirements, Hill said, "Even during the winter, office buildings produce more internal heat than necessary.

"When you combine the heat from a room full of peo-

Photo by Artie Limmer

Glenn Hill focuses on solar-assisted structures in his studies.

ple, overhead electrical lighting and solar heat gain, then there's a problem with too much heat in the space."

Hill said this situation can result in the need to air condition the building in the middle of the winter when the temperature outside may be below 40 degrees.

"As a matter of fact, there are times when the office building actually wants to dissipate heat to the outside and a high level of insulation prevents this," he said.

"By utilizing a holistic approach, the lighting load can be reduced. One way could be through the use of available light, such as daylight, which could be controlled by mini-blinds and dimmer systems that raise and lower the electric lighting levels based on the amount of available daylight in the office."

Hill said what could be advantageous beyond daylighting would be to allow the office building to lose and gain heat to the surrounding environment, much like an organism functions. For instance, when people are cold they will put on additional layers of clothing and insulate themselves. After their bodies get warm, they remove some clothing, reducing the amount of insulation.

The same is true with solar radiation from the sun, Hill said. When people are hot, they seek shade; when people are cold, they allow the sun to warm them. The same idea is behind the dynamic envelope principle. Although a building is not so dynamic, Hill says, an exterior skin of a building could be developed to change the insulation level and to allow shade.

In the first phase of the project, researchers determined that the idea has potential. They used computer simulations to ascertain if significant energy savings could be achieved with a dynamic envelope that changed its resistance to heat transfer (R value or insulation value) and its shading coefficient (how the material allows light transfer).

Hill says the first phase was quite successful. The researchers found that the heating and cooling of a building could potentially be reduced by 40 to 60 percent. They also concluded that this effect could be achieved with a material whose insulation level and shading coefficient varies very little.

Some glazing materials have the ability to change their shading coefficient, but the existing material currently cannot meet the range needed to match the computer simulations, he said.

In the next step, researchers will perform more sophisticated simulations of the dynamics of this imaginary building skin. They also must develop the artificial intelligence via computer software that would control the dynamics of the building material and determine the potential for development of a material that can meet the performance characteristics that have been identified.

"Right now we're working on the premise that it is possible to make a building dynamic enough to control the amount of heat that comes in and goes out, and that the result would save significant energy," Hill said. "Now we're exploring what materials are available to achieve this."

— Myrna Whitehead

Changes in Russia

What They Mean for Americans

(Editor's Note: The following opinion piece was written by Peter I. Barta, Ph.D., who is an associate professor of Russian and the director of the Program in Russian Language and Area Studies.)

By Peter I. Barta, Ph.D.

". . . we may be able to help to prevent the growth of intolerance, oppression and irrational extremism in Russia."

Russia is undergoing cataclysmic changes yet again. If we study Russian history, we soon realize that in this ethnically, socially and culturally divided country revolutions, political instability and crises recur with almost predictable regularity. Yet, this time it is different. The United States and the West have hitherto failed to formulate an adequate response to the crisis. Most experts of Soviet and post-Soviet affairs fully agree with the stern warnings of such former politicians of considerable international experience as Richard Nixon and Margaret Thatcher that it is folly to assume that Russia will muddle along somehow and it no longer merits top priority in political, educational, military and economic circles. We respond in a lackluster manner to events which have already taken place. Instead, we must, for the sake of the planet's stability and our own continued prosperity, try to influence the course of affairs in the former Soviet Union.

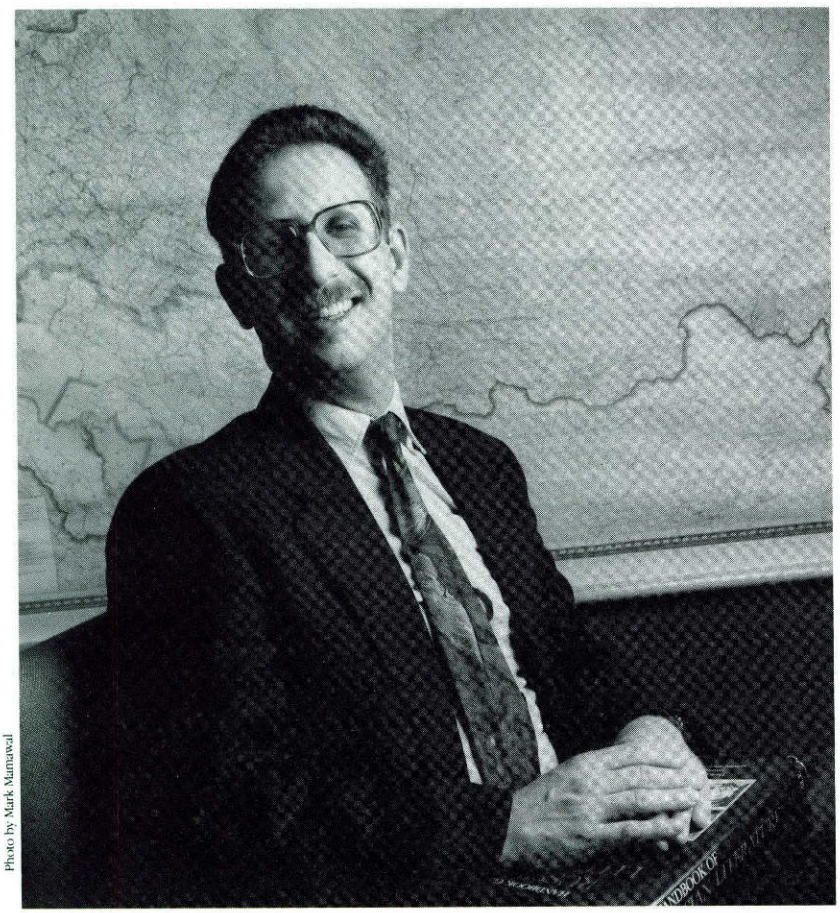


Photo by Mark Mamawal

Until 1990, the Soviet Union was governable. Gorbachev's changes in the 1980s were not inevitable, but they arose from the desire of reformist communists to improve the system. The economic structure would have had a chance to move toward a market economy from the devastating failure of the command economy of state ownership, had Gorbachev and his "New Thinking" not tried to liberalize Marxist-Leninist ideology. Stalinism has proved to be the only "successful" form of Communism: once censorship was eased and attempts at political pluralism were introduced after seven decades of oppression, the communist Soviet state was doomed.

However, the legislature, "elected" before the demise of the Soviet Union, survived and has, more or less, orchestrated the opposition against the market-oriented, moderately democratic and pro-Western Yeltsin presidency. At the present time, Russia, in addition to an economic crisis of enormous proportions, is experiencing a constitutional crisis unimaginable in any Western country. The question of who should have executive powers, the president or the legislature, is unresolved.

Attempts to Westernize Russia have come under attack from the following groups:

1. The former "apparat:" bureaucrats threatened with the loss of their relative comforts as the former communist establishment's existence is threatened.

2. Russian (and Slavic) nationalists who fear that consumerism will eradicate their culture: this group includes erstwhile Stalinists, newfound monarchists and advocates of the values of

the Russian village, supposedly threatened by cosmopolitanism and "urbanism."

3. A growing number of ordinary citizens, unable to benefit from the new opportunities of the poorly organized free market: the country faces hyperinflation and millions of people have lost their savings. The state-subsidized economy has collapsed, and average incomes are insufficient to keep up with the price increases.

It is clearly in the interest of the United States to devote far greater resources than it so far has to supporting financially the pro-democratic, pro-Western forces in Russia. These include (a) business and banking specialists whose attempts to persuade the population about the benefits of a capitalist economy are doomed to failure as long as the country and the citizens have no real capital to invest; (b) the majority of the influential Russian intelligentsia, thrilled by its new rights of expression, travel and academic freedom; (c) substantial segments of the Russian military who know very well what the consequences would be if their services were put to use in a confrontation with the West or against their own population.

Those who argue that Russia is no longer of prime importance as an area of study because it has ceased to be a "superpower" are very mistaken. The coup of August 1991 gave us a flavor of what it is like when things are really out of joint in Moscow. If anarchy or the spirit of confrontation with the West were to prevail in Russia, all other crises in the world, such as those in the former Yugoslavia, the Middle East or Somalia, would seem negligible. The nuclear capabilities of the former Soviet Union are vast and the fate of these materials is uncertain. Nuclear proliferation, accidents and terrorism are very real dangers. Russia, not to mention all the other republics, contains the potential for numerous ethnic confrontations just as violent as those in Bosnia-Herzegovina. Nationalist rivalries and civil disobedience could trigger off the flight of literally millions of refugees to the West.

Russia has been and will remain the most important foreign power for the United States to consider. There is a 50 percent chance that Russia eventually will evolve into a successfully managed democracy. Such an outcome would be the best thing that could happen to the United States. Business opportunities for Americans in Russia could be historically unparalleled. Even at the present time, U.S. goods, ranging from jeans and soft drinks to cars, aircraft and computer technology, have — to a large extent for psychological reasons — an unrivalled cachet for Russians. American culture and American English are more popular in the streets of Moscow and Petersburg than anywhere else in the world. Travel to, or education in, the United States also attracts Russians like no other country. The number of teachers of English in Russia is 10 times larger than the number of students of Russian in this country.

A Russia which is friendly to the United States makes it possible for the United Nations to play, for the first time since World War II, a constructive role in defusing tensions around the world. The alternative to having a friendly neighbor in Russia is not a neutral or indifferent neighbor, but an outright hostile one.

How can we try to steer events in a favorable direction in Russia? We can certainly encourage our government to take a more active interest in matters. But, more importantly, ordinary citizens can do perhaps more than governments in expanding contacts: going to Russia, investing sensibly in Russian and joint enterprises, teaching management skills, and making it possible for Russians, mainly young people, to come and find out about this country are crucial. Without a knowledge of Russian, however, such contacts are inconceivable. While all educated Russians tend to know some English, we cannot even begin to understand their way of thinking, their historical and social consciousness without studying their language and culture. There are far too few centers of Russian studies in the United States, although the student interest is clearly there.

Texas Tech University is slowly evolving into a regional center of Russian language and area studies. During the past six years, student enrollments in the Russian language program have increased by almost 400 percent. We established an interdepartmental program and a major in Russian studies: the Russian language and literature of the classical and modern languages and literatures department, the history, economics, political science, geosciences and art departments participate in teaching courses for the program. The bachelor of arts degree was authorized two years ago, and within months it had 55 undergraduates majoring in Russian language and area studies.

Other units at Texas Tech have shown considerable interest in Russia too. The Russian Club, a highly successful student organization, has hosted some 60 lecturers, many of them from Russia, over the past six years. Three conferences on Russian culture have taken place during the same period. The College of Arts and Sciences, the Office of International Affairs, the department of electrical engineering, the department of mathematics, the College of Business Administration, the School of Music, the department of theater arts and dance, to name organizations that come most immediately to mind, all have promoted Russian studies at this university.

Recent cooperation between the Russian language and area studies program and the College of Business Administration to implement the master of business administration degree with specialization in Russian is highly promising. An unexpectedly large number of undergraduates have expressed interest in the joint degree. They now will be able to stay here to study business administration and Russian on the undergraduate and graduate level. Such a qualification is in great demand; nationally, very few business people speak Russian and have the necessary knowledge about the former U.S.S.R.

Russian is an easier language to learn to speak than many commonly taught foreign languages in the United States. The culture and literature never fail to fascinate those who undertake the study of the language. All Americans, moreover, have a vested interest in seeing a more stable society in Russia. It is vital for this country to have a better understanding of history, society and culture in the former Soviet Union. If we are able to predict the course of events, we may be able to help to prevent the growth of intolerance, oppression and irrational extremism in Russia. These, coupled with a vast nuclear arsenal, present the greatest threats for the United States and Western civilization in the foreseeable future. □

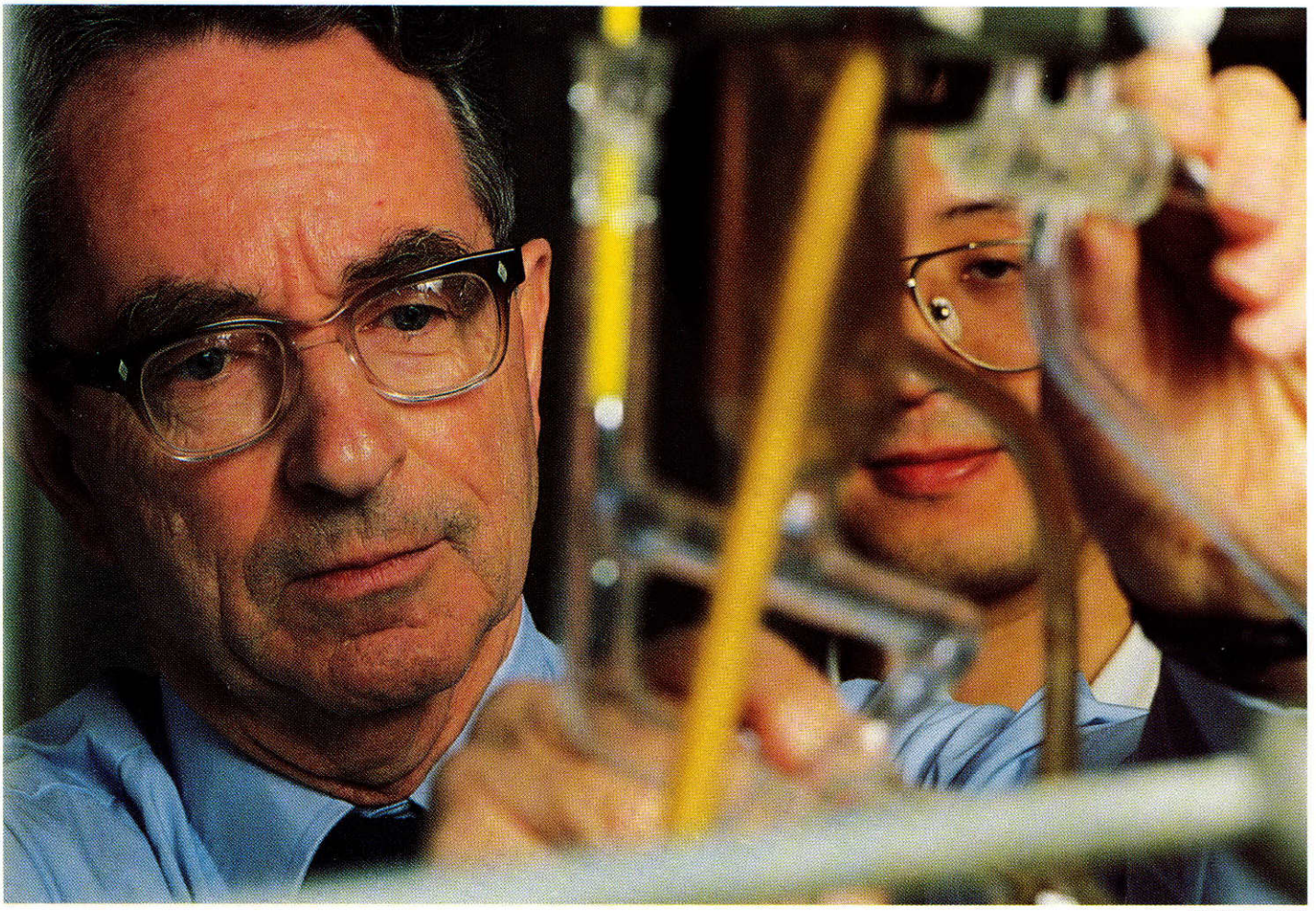


Photo by Artie Limmer

Answering the essential questions has enabled Henry Shine (left) to train dozens of chemists, among them is Wang Yueh, a graduate student from Taiwan.

A Chemist's Holy Grail

By Michael Sommermeyer

What he had achieved would change the way chemists look at organic chemistry.

Successful people talk about the thread that guides their lives. They call it the hand of God or fate or luck, and these accomplished few recognize and respect the guiding thread, whatever it is called, for its power. The thread can pull a person headlong into success or split in two and offer a choice of paths. The first path leads to a great discovery; the second, a grand achievement. Only occasionally does the thread take a person down both paths to treasures that are far greater than anything anyone would have imagined. That is what happened to Henry J. Shine, Ph.D.

Chemistry's thread recruited Shine in 1948. This Englishman put on his armor of chemical fundamentals and theory and began on a quest worthy of a scholarly knight. Shine did not ask for this crusade: it happened quite by accident as he began a postdoctoral fellowship at Iowa State College of Agriculture and Mechanic Arts — now Iowa State University. Shine was teaching an undergraduate class, when one of his students asked him if he knew how a chemical phenomenon, the benzidine rearrangement — a reaction in which a molecule called hydrazobenzene turns inside out — takes place.

Over the years the benzidine rearrangement became known as a chemists' Holy Grail — the ultimate discov-

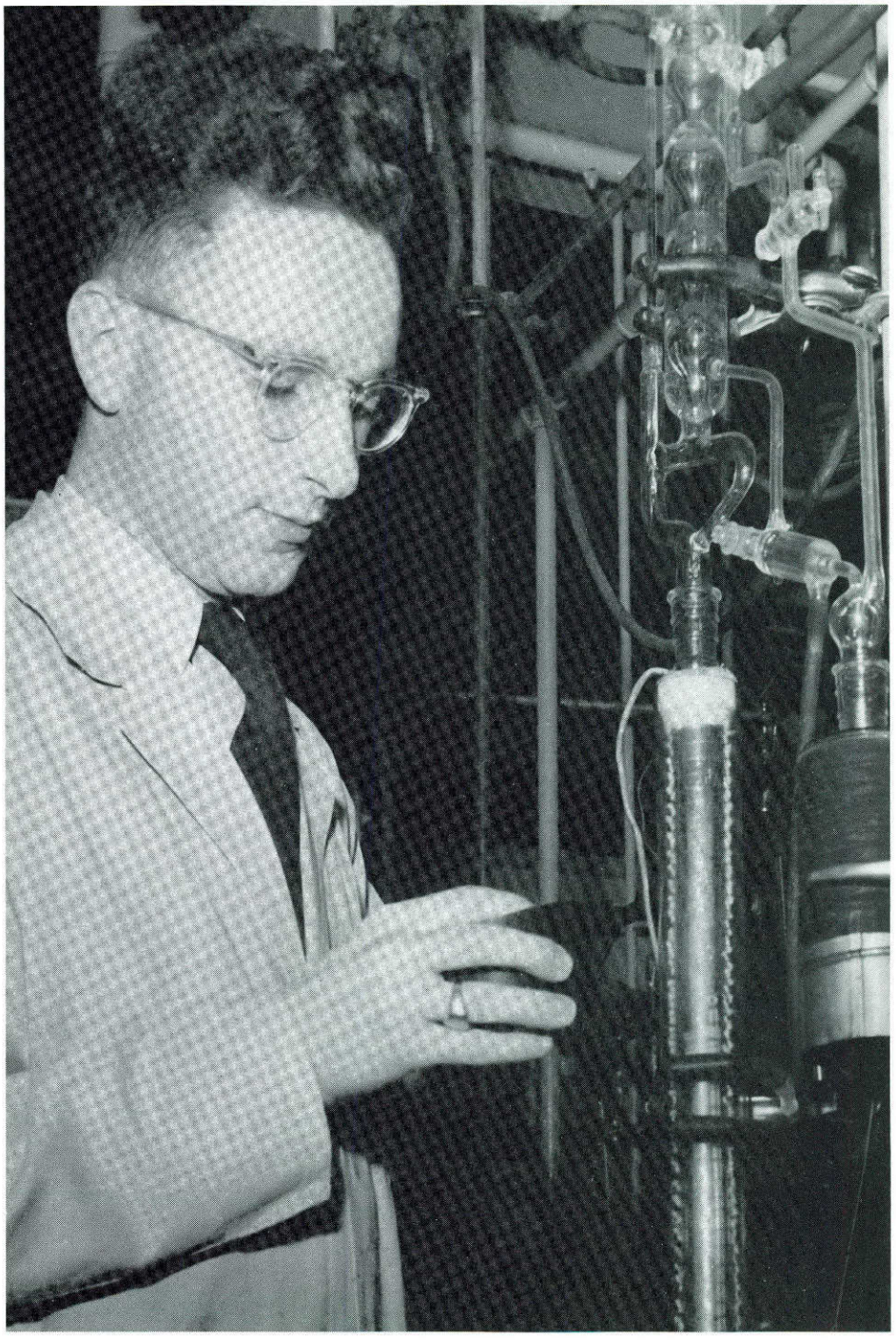
ery — and nobody understood how the rearrangement really took place. Most of the characteristics of the reaction had been defined by German and English scientists, however exactly how it was happening was not known. "Fortunately I was smart enough to tell the student I didn't know," said Shine. "I could have fudged it off, but I genuinely didn't know the answer, and I was honest enough to tell him. I thought it would be a simple answer, but nobody knew."

So Shine began a chemical quest and from that question began a lifetime of work. Eventually through his research at Texas Tech University, where he currently is a Horn professor of chemistry, he uncovered the mystery of the benzidine rearrangement. However during his journey, he stumbled upon a discovery far greater than the chemists' Holy Grail; he unveiled a new branch of organic chemistry called cation radical chemistry.

Finding cation radical chemistry came quite by accident while Shine was searching for the key to the benzidine puzzle. In one experiment, Shine decided to create an analog, or something similar, to the benzidine rearrangement. He wanted to duplicate the reaction in which a simple molecule of hydrazobenzene is placed in a solution with a small amount of hydrochloric acid. Under the reaction with the acid, the molecule turns inside out. "Even though I didn't know how it took place, I knew what happened, I wanted to try an analogous reaction in which sulfur atoms were placed in the molecule rather than nitrogen," Shine said.

In hydrazobenzene, nitrogen atoms are in the molecule. Shine wanted to replace that element with sulfur atoms to see if analogous chemistry occurred. Instead something remarkable and unexpected happened. Rather than turning inside out, the molecule changed into a new structure that was purple in color. Little did Shine know at the time that in front of him was what he would later call the thianthrene cation radical.

Although no one could explain the structure of the compound that was responsible for the purple color, Shine had a pretty good idea. "I deduced that it had to be a certain type of structure. It is like playing a detective game, you take all the clues and fit them together and you say I know the murderer, now let's go find him," Shine said. "I thought I knew what was making the color and thought I knew what was responsible for the chemistry, but I could not prove it with the limited facilities and techniques available at Texas Tech at that time." Shine surmised that he had discovered a new reaction intermediate, the cation radical, but special tools were necessary to prove his theory right.



Henry Shine (photographed here in 1952) held his first American industrial job as a research chemist with the U.S. Rubber Co. of Passaic, N.J.

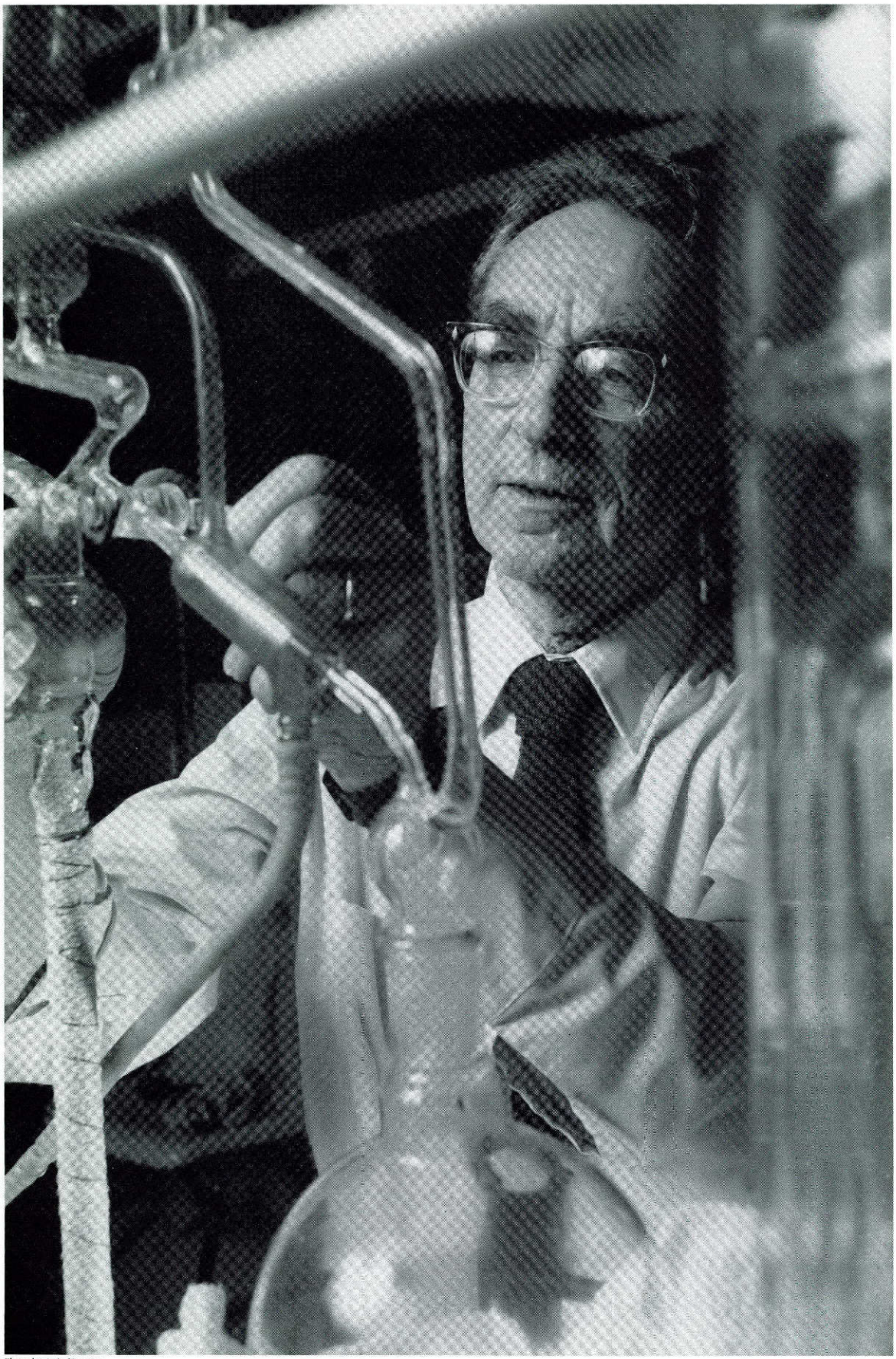


Photo by Artie Limmer

Continuing his lifetime study of what makes chemistry work, Henry Shine still is leading other scientists to find practical applications for cation radical molecules.

To honor Henry Shine on his 70th birthday in January, the department of chemistry and biochemistry organized a "Symposium on Electron Transfer Reactions in Organic Chemistry." Shine himself offered a talk on "How I Stumbled on and Got Hooked by Electron Transfer."

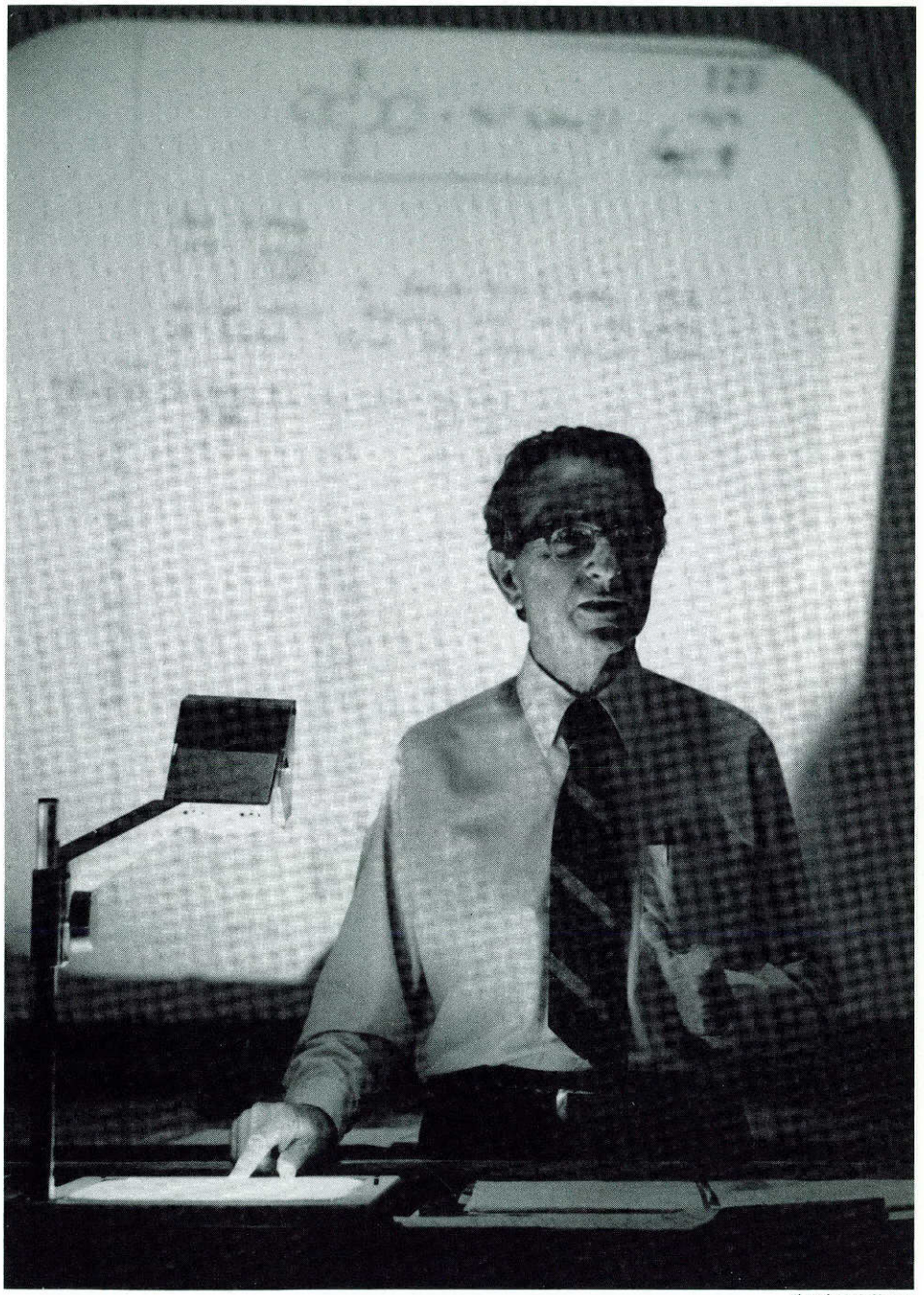


Photo by Artie Limmer

In 1962, some years later, Shine traveled to Varian Associates in Palo Alto, Calif., to learn how to use new analytical techniques called "nuclear magnetic resonance spectroscopy" and "electron spin resonance spectroscopy." Nuclear magnetic resonance (NMR) spectroscopy is the same technique now used in medicine in magnetic resonance imaging. The principals were being worked out in the early 1960s, and most chemists began to learn them at that time. Electron spin resonance (ESR) spectroscopy, also then a new technique to most chemists, has a distinctive role in unraveling the nature of molecules. Under ESR spectroscopy, the molecules spin and turn, and the pattern of their movement is captured as a graph of electronic impulses.

In most molecules, atoms are held together by pairs of electrons. However, some molecules have an electron that has no partner making them cation radicals. The presence of an unpaired or unpartnered electron can be detected by a chemist using electron spin resonance spectroscopy. In 1962 no university in Texas had facilities for doing ESR experiments, and Shine had to go to Palo Alto to learn the technique. It was the only way he could prove his discovery of the thianthrene cation radical.

With the assistance of Larry Piette, Ph.D., at Varian, Shine began his experiments under the searching rays of an ESR spectrometer. Slowly the purple color of his reaction appeared, and when it did, the instrument captured its

nature. Shine had been right. His reaction had produced a molecule that had lost one of its electrons to become a positively charged radical: the thianthrene cation radical.

"With this simple technique, which is now taught to all our graduates and undergraduates, I was able to prove what it was I was doing and had unraveled here at Texas Tech. It was a thrilling week," said Shine.

In 1968, Texas Tech University named Shine a Paul Whitfield Horn Professor for making contributions in research that have earned national and international recognition. The award is the highest honor that Texas Tech can give to a faculty member. "I was 45 years old and Texas Tech made me feel as if I had achieved something outstanding," Shine said.

What he had achieved would change the way chemists look at organic chemistry. A cation radical is a positively charged molecule that has an unpaired electron, so its obvious desire is to find a partner. When the molecule finds one, the pairing of electrons is called electron transfer, something with far-reaching implications.

Suppose a researcher takes a cation radical that he or she has created in the lab. That unpaired electron has a desire to couple with another. This need to couple and become stable compels the cation radical to approach a molecule that has all of its electrons paired and to remove one of them through electron transfer. When that happens, the molecule that was once a cation radical becomes an ordinary molecule. However by becoming stable it creates a new cation radical. "But the new cation may have such different characteristics that all sorts of things could happen to it once it has lost one of its electrons," said Shine. "Through this process you initiate a new kind of chemistry by electron transfer."

By explaining how cation radicals cause electron transfer, Shine began a branch of chemistry that is at the essence of many physiological processes. For instance, photosynthesis involves electron transfer with the help of a cation radical. "What causes the initial electron transfer is a ray of light, that's why it's called photosynthesis. A ray of light causes a chlorophyll molecule to lose an electron. You get a chlorophyll cation radical, and that cation radical initiates a large sequence of physiological reactions called photosynthesis," Shine said.

The discovery of the thianthrene cation radical has helped other scientists explain many other reactions involving an electron transfer.

"Some biologists believe cation radicals are at the core of the carcinogenicity of some compounds, but I don't do cancer research. The process of what makes us grow older is believed to involve principles of cation radical chemistry, but I don't do that either," said Shine. "However that one reaction led to the understanding of a lot of others." There are unlimited numbers of reactions that can be developed from this new branch of organic chemistry, and this development came about because Shine wanted to understand why a simple reaction produced a purple-colored result.

In the process of studying what makes chemistry work, Shine has led other scientists to find practical applications for cation radical molecules. Since 1954, Shine has led 19 doctoral students and 21 master's students to graduation. He has worked with 45 post-doctoral associates in his lab, and he has written 152 papers and 14 book chapters. Shine graduated with first class honors with a bachelor's degree in chemistry from University College in London in 1944, and he earned a doctoral degree in organic chemistry from London's Bedford College in 1947.

Shine also has spent time teaching and lecturing in labs from Pittsburgh to Rome and Warsaw to Sydney. In 1980 he spent a semester in Grenoble, France, at the Centre d'Etudes Nucleaires. Eugene M. Genies remembers the visit, "When I was a young research worker completely lost in the mountains of France, the papers of Henry Shine were for me the table of the law. It was a reference; it was a way of thinking on radical cation chemistry. Henry Shine was for me a kind of prophet, or even a god of the activity of cation radicals," said Genies. "And one day this god of chemistry came from America to work with me. I was very impressed to meet this star of chemistry. I was surprised to observe that this star was also a man, a man with his sensitivity, an excellent man, with a very good judgment in chemistry."

Shine's research into cation radicals has been supported by the Robert A. Welch Foundation of Texas for more than 30 years. He also has received grants from the National Science Foundation, the State of Texas, the Air Force Office of Scientific Research and the Petroleum Research Fund of the American Chemical Society. His grant support since 1955 totals $2.94 million dollars. His research has earned him a reputation as a chemist who discovers fundamental processes and then explains how those processes work in a language anyone can understand.

John J. Eish, professor at the State University of New York, credits Shine with teaching others how to prepare cation radicals, characterize them and assess in an expert way their mode and rates of chemical reaction. In a personal letter to Shine, Eish writes, "For those of us in radical ion research your career of scholarly work has established the importance of cation radicals as important intermediates in organic reactions."

It was his good judgment in chemistry and the soul of a detective that led Shine back to his initial quest: the benzidine rearrangement. From the moment that undergraduate student at Iowa State had asked Shine, "What causes the benzidine rearrangement?" he hadn't given up thinking about it. So in 1972, after years of pondering and reasoning, he believed he knew how to solve the mystery, but it would take a new way of looking at rearrangements. Soon this Holy Grail of Chemistry would be on Shine's shelf on display for other chemists to admire.

In the benzidine rearrangement, chemists knew that the molecule turned inside out. However they did not know if the atoms in the middle separated from each other before atoms at the end joined up, in a two-step process, or if the middle separated at the same time as the ends rejoined, in a one-step process. This rejoining of atoms happens very quickly, so chemists needed to find a way to slow down the rearrangement.

The process for slowing down the atoms came in using heavy atom isotopes, a technique Shine developed at Texas Tech. "Now it may seem to you a small point, the reaction occurs, so why do you want to know," said Shine. "Well it's one of those things chemists want to sort out. You can't do new things with molecules unless you

understand how they behave."

In the heavy atom isotope approach, Shine places heavy atoms in the center of the molecule. For example, a molecule might be joined together by two nitrogen atoms while at the molecule's ends there are two carbon atoms.

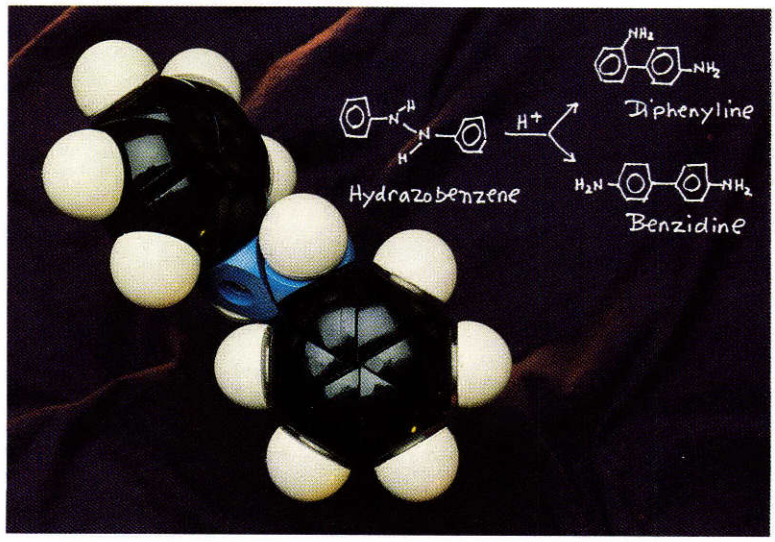
What Shine did was to replace the nitrogen atoms with heavier nitrogen atoms. He then measured how fast the heavy nitrogen atoms broke apart as compared with the lighter nitrogen atoms, and he observed that the reaction was slower. Shine then did the same thing with the carbons, and he found that the reaction also was delayed.

Shine was able to show that if researchers slow down the reaction in the middle, by putting in heavy isotopes, and they slow down the reaction at the ends, by putting in heavier isotopes, then the rearrangement must be behaving in an unified, concerted, single step. If each of these atom changes does not make the reaction slow down, then it must happen in two steps.

In the benzidine rearrangement, Shine's experiments showed that the ends join while the middle separates to create a new molecule. With this discovery Shine answered an undergraduate's question, finished a journey and contributed to the understanding of chemistry.

"You could not prove the basics of a rearrangement earlier, and we thought of doing it here," said Shine. "The 'Heavy Atom Isotope' technique was obvious once we had done it, but nobody thought of using heavy atoms before. We now use the technique to solve reactions of a similar nature. We've gone from the benzidine rearrangement to a large number of other reactions in which the only way to find out if the molecules rearrange through a one-step or two-step process is by using heavy atom isotope effects."

Throughout Shine's career, the essential questions — like how fast a rearrangement takes place — have enabled him to train chemists at Texas Tech. "We look at the fundamentals. We don't know that it's going to make money for anybody; we don't know that it's going to solve the world's chemical problems; but we do know it answers a question. Once we answer a question, then it may be that other people may say we can use that technique to do something," Shine said.



A space-filling model shows the hydrazobenzene molecule before the benzidine rearrangement.

Ken G. Hancock of the National Science Foundation calls Shine's work on the benzidine rearrangement a classic. "It is a landmark study which exemplifies how the concept of physical organic chemistry can be used with exquisite beauty and precision to unravel a complicated reaction mechanism," said Hancock. "It is genuinely a benchmark study, a paradigm for the field, and a textbook case to pass along to a new generation of students. Very few chemists can claim such a splendid success in their careers."

In January Shine celebrated his 70th birthday and was honored by the department of chemistry and biochemistry with a "Symposium on Electron Transfer Reactions in Organic Chemistry." Shine's former post-doctoral students and colleagues from Poland, Japan, Korea, England and the United States gathered on campus to celebrate this man who discovered the cation radical and unraveled the mystery of the benzidine rearrangement.

Fellow Horn Professor Richard Bartsch organized the symposium. "He's been such an excellent role model in the department. Shine is a mentor, someone who you can look up to and emulate. Certainly he has always been a powerful researcher and a good teacher and works very hard," said Bartsch. "This has been helpful to me, particularly when I've thought, 'Well it's Saturday at noon, maybe I ought to do something else other than chemistry,' but I walk down the hall, and here's Dr. Shine working away. I really owe him for providing that kind of a role model in the department."

Shine says every three years a scientist sees that his grant period is about up, and he must start thinking about a new problem to solve. Shine considers his career at Texas Tech as 13 granting periods, or 39 years of research. And as he begins his 14th grant period, Shine is far from finishing his work. He recently sent new research proposals to the Welch Foundation and to the National Science Foundation for further studies of cation radicals and heavy atom isotopes.

When asked how he would describe himself, Shine quickly answered with two words: "hard worker." This man who discovered a branch of organic chemistry and found a way to slow down a rearrangement pondered why he thought of that description. "Isn't that interesting; that just popped out. But all along, all I have wanted to do was work in the lab and satisfy my own curiosity. I don't want to pretend to the outside world that I do chemistry to solve global problems; I'm not made that way," Shine said. "Now there are chemists that are made that way, they work in industry, or they work in government labs. But I'm working to just answer fundamental questions and to train people to become chemists."

For Henry J. Shine, chemistry's thread has generously given him magnificent gems of the fundamentals of chemistry, and in the future, Shine's thread will pull other researchers and chemistry students down its path to even greater discoveries. Shine's thread will not break; it will go on indefinitely. □

Photography by Artie Limmer

Magic & Fire

By Kippra D. Hopper

The late mythologist Joseph Campbell observed that in practically every primitive society ever studied people believed the smearing of paint and clay on the body imparted magical protection as well as beauty. Even today, potters wear splattered clay stuck to their skin and clothes like a badge of honor.

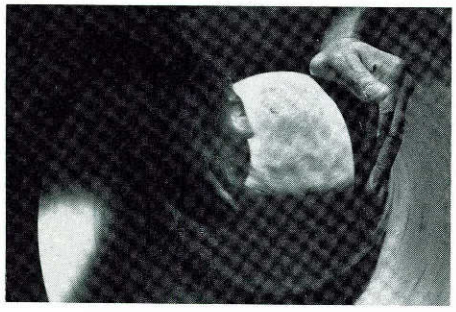
So certain that life is connected to magic, James C. Watkins plays with fire. And what he dreams at night becomes the forms he throws on the potter's wheel then offers to the flames of the kiln.

What emerges are immense clay pieces that evoke images of the Earth, the land, to which Watkins always has sensed a connection. The Texas Tech University artist and architecture associate professor has come to be known for his double-walled caldrons and two-foot diameter platters that exhibit his appreciation for the milieu of the Southwest.

When he first moved to Lubbock, Watkins said, he was overwhelmed by the land's vastness, flatness and abrupt gorges. "Linear elements were everywhere — fences, cultivated cotton fields and grain elevators. But the most awe-inspiring phenomena of all were the dust storms. I began to gather dust after these storms to make terra sigillata (liquified clay)."

Watkins frequents the canyons and desert lands of the region, not only to find visual stimulation, but also to retrieve elements to use in his work. "I dig up clays from dried up river beds

and on the sides of mountains and in caves. I enjoy bringing back clays and colorful rocks to my studio and finding out what they do. Everything does something. It also adds an element of surprise. There is a kind of serendipity about it, discovering something new."



Most recently Watkins has added an innovative sculptural dimension to his work by incorporating animal and architectonic forms, which he first conceived in a dream. "In the dream I saw these forms with heads and appendages coming out of the pots, and the next day I made my first one. There's an endless variety of things I can do with that rim."

Becoming interested in dreams while he was in graduate school at Indiana University in Bloomington, Watkins learned about the Senoi people in Malaysia who taught themselves and their children through autosuggestion how to remember their dreams and how to become conscious while dreaming.

"I started practicing this, and of course it doesn't happen every night, but when it does happen, it's wonderful," he said. "You can touch objects and look at things that are very similar to objects you see in the awakened state. I keep a journal next to my bed, and I'll either write down the dreams or draw them. A lot of the pot forms have come from the dreams."

He said that earlier in his life his mother influenced his curiosity about dreams, just as both his parents affected many aspects of his artistic pursuits. "My mother believed that the color of your clothes could influence your emotional state. She believed that red and orange would make you more alert and happy. My father, who was a farmer, believed that painting the house true green would ensure a good harvest. So we were six children — three girls and three boys — wearing brightly colored clothes, alert and happy, living in a green house."

Watkins explored other inspirations for his art in his article titled "Pots Made of Memories," which was featured last summer on the cover of **Ceramics Monthly**, the most significant art publication in claywork. About his career in which his work has been included in more than 90 solo and group exhibitions throughout the United States, he wrote: "My current work grows out of the experience of scaling canyon walls to view ancient pictographs among plants and animals that poke and bite; out of memories of my mother and grandmother washing clothes and making soap in large cast-iron caldrons; out of the story of my great uncle who dug up a caldron filled with gold; and out of the realization (after a near-death experience when I was pulled from a lake by my wife) that life is connected to magic."

Now Watkins is waiting to begin another endeavor that undoubtedly will stimulate his future work: Beginning in February 1994, he plans to spend six months in Japan to experience a culture that has been called a living museum. During his stay, he will pursue his research concerning contemporary architectural ceramics, an emerging art form, in a country considered to be the melting pot of ceramic techniques of the world.

Watkins is one of six crafts artists in the United States — selected from a pool of 1,664 applicants — to be recommended by the National Endowment for the Arts to act as a U.S. Cultural Exchange Artist. From the university, he has received a faculty development leave for his visit, in which he also plans to travel to Korea and China.

His study for a future book involves surveying artists who deal with clay in an architectural framework: making walls, tiles, fountains and large individual sculptural pieces with ceramics as part of the architectural environments of buildings.

"There's a new trend for architects and people involved in buildings to make the structures more user friendly and to create more of a sense of human scale so that the buildings don't feel so alienating. They are adding textured walls, using lots of colors and making things that are human-sized," he explained. "Because ceramics are durable, easy to clean and low maintenance — they don't have to be painted once the glaze is on — they will last forever."

Watkins began his research in 1990 with a State Organized Research Fund Grant that financed a trip to New York City. Also that year he received a Texas Tech University travel grant, which supported him for three weeks in England and Paris while he identified artists that are involved in architectural ceramics.

The journey to Japan not only will advance his research and enhance his own artistic growth, Watkins said, but also will strengthen his work with students in the College of Architecture where he teaches Architectural Delineation I, II, III and a delineation specialization elective course called Entourage.

Drawing parallels claywork, which essentially is a three-dimensional drawing, Watkins said. Having a great passion for drawing, he remarked that the surfaces on his pots and platters consist of two-dimensional drawings and illusions to space. Watkins invites his students to think about rhythm, harmony and movement in their own work by connecting art and music. He asks them what sound the particular creation would make.

"I think drawing is a lifetime activity because you're always trying to sensitize yourself to see more, to see all the subtle things," he said. "I talk to my students about this a lot. They seem to understand that drawing is a life-enhancing kind of process when you can see shadows, reflections and forms

Artist James Watkins creates sculptural two-foot diameter platters, such as his pieces (left to right) "In & Out" and "Sleeping Posture," and double-walled caldrons, such as another "Sleeping Posture" and "Intimidation Posture."

all around you and get ideas and inspiration from these things."

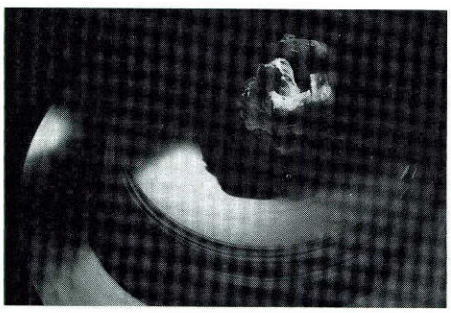
The path toward his lifework in art originated with drawing for Watkins, who had intentions of becoming an illustrator for magazines. Fascinated with drawing even at age 3, Watkins would sit on the floor drawing picture after picture of his great-grandmother, trying to understand perspective. Later his mother collected magazines with "Draw Me" advertisements for an art school contest and she would mail in Watkins' completed images. When he was 16, he finally won a contest and started a correspondence course in art.

Later, enrolled in a local junior college near his family's home and farm in Athens, Ala., Watkins was studying design and drawing until one day when he passed a pottery class and became captivated by the cooperative spirit in the studio. "Everyone seemed to be having a great time. All the wheels were taken, so I bet a student a dollar that I could make a pot the first time I tried.

Able to make a short, dumpy, ugly pot, I was obsessed from that moment on," he remembers.

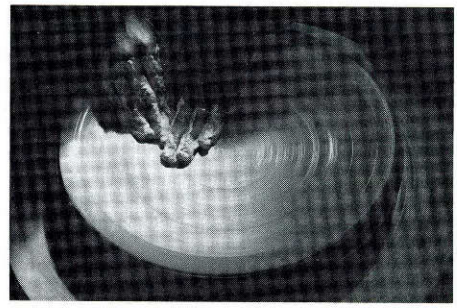
After finishing his undergraduate work at the Kansas City Art Institute, Watkins entered graduate school at Indiana University and found another love — teaching. Fifteen years later he was rewarded for his efforts: In 1990, he was honored with a President's Excellence in Teaching Award by Texas Tech. In a nomination letter, R. Wayne Drummond, then dean of the College of Architecture, wrote: "Watkins is an outstanding artist and has achieved national recognition for his work. His remarkable talent and obvious skill are assets he brings into the classroom and his students benefit tremendously. He is admired and respected by both his students and colleagues; his students strive harder to produce truly creative work under his guidance; his colleagues rise to the occasion and continue to grow in their creative efforts."

Watkins repeatedly praises his students and evaluates his strength as a teacher by his ability to make them believe they can be creative. One rule in his classroom is that students are not allowed to say "can't," and when they are frustrated with drawing, he assists them through example and repetition. Watkins emphatically believes that anyone can be creative.



"A lot of the architecture students have a left brain orientation; they are analytical; they are mathematicians and they want to build structures. Many of them come into the classroom with no real art background, no freehand drawing, no painting. Some of them are insecure, but they are able to learn to draw. I've seen people come in who couldn't draw a straight line, and at the end of their three semesters, they're able to draw beautifully," he said.

Before he began teaching at Texas Tech in 1983, Watkins was the director and organizer of the MacKenzie Terrace Pottery Center in Lubbock. In that position he taught clay to a diverse socio-economic and ethnic group of people who shared the goal of making the most beautiful object of clay they could. Watkins deems art to be vital to a community. "I believe that you can measure the health of a community by the level of its involvement and support of art and cultural programs. Art and cultural programs are life-enhancing activities. It doesn't matter whether you are actively performing, making art or appreciating the creative efforts of others. The reward is the same: a kind of food for the soul — for the spirit."



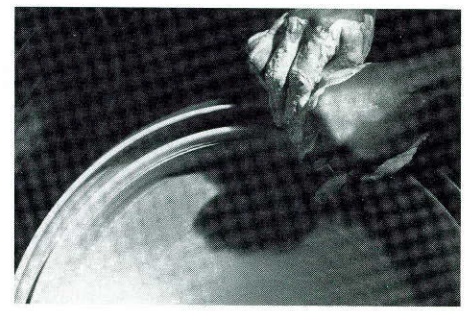
Whether in a community education setting or in an academic classroom, Watkins approaches teaching with the tenet that "the discipline of making art is not an end in itself but a means of making the individual more intimately aware of phenomena great and small in the external world and the internal world of visions."

The key to the creative process, Watkins considers, is to be receptive, to relax, to absorb everything and to resist taking anything for granted. "When you absorb, you become full and eventually it will all come out some way through something creative, either writing, drawing, ceramics, sculpture, poetry, music, it doesn't matter. If you are filled with the wonderful stuff you are absorbing, you have to be creative, you have to do something, you have to respond in some way."

Watkins reminds his students that daily they make creative choices, for example, in the selection of their clothes and colors, in their hair style, in their makeup, in the arrangement of their homes.

"If you can see, not just identify objects, but really take the time to take a deep breath and look at something, look at all of the subtleties and become an acute observer, then you can begin to put some of that down on paper. It's a building up process, and eventually, you have this wonderful thing that's three-dimensional and it's standing there staring at you wanting to pop off the page out of nothing," he said.

Personal experiences are manifest in Watkins' art. He often refers to a near-drowning incident as providing him with many of his foremost insights. "I was swimming in a lake with my wife (Sara Waters, a Texas Tech art professor, sculptor and musician, whom he met at Indiana) when my body began to cramp. My life flashed before me, like I was looking at a movie screen, images moving from left to right. It was only a matter of minutes, but it was like I was being taught a lesson that life was beautiful and wonderful, and I was taking it for granted. That experience has really affected my work. I don't worry about ideas. I just look around me and draw from what I see."



He also tells the story of working on the exhibit "New Visions from Rattlesnake Canyon," a project in 1988 by 11 contemporary artists, mostly associated with Texas Tech, to explore their emotional responses to 4,000-year-old Indian pictographs. The primitive rock art is found along the Rio Grande and Pecos River near Del Rio on land owned by Texas Tech.

On his first trip south to Rattlesnake Canyon, Watkins got lost driving at dusk in the desert on a dirt road that crossed ravines and washes. A huge snake, the largest he had ever seen, crossed the road, and Watkins accidentally ran over the reptile. "It sounded and felt like a speed bump. I stopped the van to get out to see the road kill, but I couldn't find the snake anywhere. I got real paranoid and began to think that the snake had wrapped itself around my motor and was going to crawl through the vents and eat me alive while I was lost in the Pecos wilderness. So, as soon as I got back home, I made this pot that I call 'Snake Crossing.'"

Often called "monumental," Watkins' works recently were exhibited in a one-person ceramics installation at the Southwest Craft Center in San Antonio. Making large pots always has yielded a challenge for Watkins because he is fascinated by being able to control that amount of clay, 28 lbs. alone for the platters.

In a **San Antonio Light** article, the show's curator, Ric Collier, observes, "I don't look on Watkins' works as bowls and platters. They are sculptural pieces. But they are sort of about Watkins, too, because they are so large and the expanse is so unreasonable."

Watkins replies: "Yes, I'm six foot, two inches tall and have large hands, but my size doesn't have a lot to do with the forms. They are made with a technique of throwing the pot to a certain height, then letting the clay stiffen, then adding more clay and pulling up an additional height. Theoretically, you can make the pot as tall as you want. This is an ancient technique that cultures throughout the world have used."

In another reference to the proportions of his work, art critic Janet Tyson of the **Fort Worth Star-Telegram** describes Watkins' technique of joining an inner wall and an outer wall in his caldrons, which appear to have sides that are 5 inches thick.

"Not to dwell on technique, but it's important to understand the extent to which Watkins deals with illusion in his work. He attempts — successfully — to evoke a form on a mythic scale. His stumpy, mortar-like vessels seem fit for a race of giants, and, as this series of pots is an homage to ancient American Indian tribes of West Texas, that seems quite appropriate," she writes.

Although most of his work results in those massive and assertive pieces, Watkins — who incidentally holds a black belt in tai kwondo — says his favorite pot is a small composition that sits at his home on the fireplace mantel. He is in wonderment over the colors, the depth of the smoking and the texture of the pot, which was pit fired in an experimental kiln firing at the Texas Tech Center in Junction.

Every summer Watkins teaches clay at the South Texas campus where he and his students experiment with the firing process based on the concept that everything — from toothpaste to orange peelings — results in some unique effect. Clay is like alchemy, Watkins remarks, because a person can transform something very common and abundant into something precious, and often unanticipated.

"You have different stages, and each stage is important and has its own reward. Lots of times when you're working with clay, you'll have an idea about what you want the glaze to look like or what you want the surface to look like, but the fire will do something unexpected. It can be beyond your own sensibilities. You look at it and you think I couldn't have done that, how did this happen. That was not in my vocabulary. I didn't have that kind of knowledge that this would do this. It's very inventive and always has an element of discovery," he said.

The insatiable need to be creative, to leave a record of visual language that records our perceptions of the world around us, is a common thread that binds all cultures, Watkins reiterates. "The magic of art is that it has the potential of being a cultural link that bridges varied temperaments and sensibilities," he says.

With eyes open, we can see, and those observations eventually reemerge — like a Phoenix out of fire. □

Creating "monumental" pieces, James Watkins is fascinated by being able to control great amounts of clay on the potter's wheel.

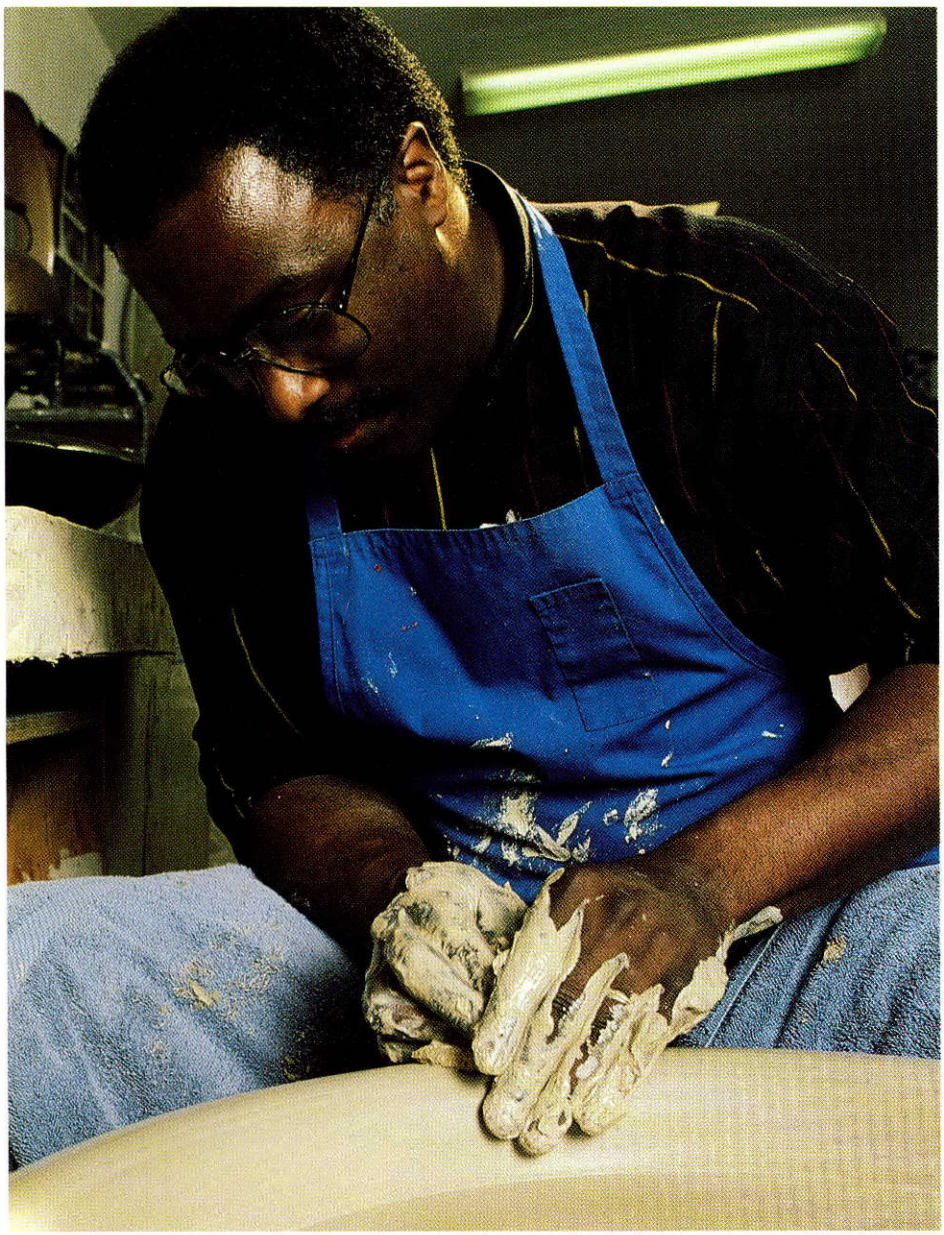


Photo by Artie Limmer

"The Real World"

Preparing Students for Jobs

By Wayne Barringer

For years, Americans have heard and read about the superiority of educational systems in Japan and Germany. Both foreign competitors also have received accolades over U.S. companies for their prowess in business and manufacturing.

Vigorous studies have resulted in efforts to find out how Americans can better educate students and more effectively manage businesses. Now, thanks to the initiative of a few high school and college teachers and a $5,000 grant, a unique study of business and education seeks to join companies and schools in a cooperative effort to better prepare students for jobs in the proverbial "real world."

The program is called Texas Tech-Prep, and Texas Tech University researchers are at the forefront of the concept-testing process.

According to a report issued by the U.S. Department of Labor, more than half of young high school-aged people leave school without the knowledge or the educational foundation required to find and keep a job, said L. Diane Miller, Ph.D., associate professor of mathematics education in Texas Tech's College of Education.

Miller says Tech-Prep aims to bring businesses and schools together to integrate practical job skills into a liberal arts curriculum, which many students often consider irrelevant and boring. The program encourages teachers themselves to investigate how companies are working and what skills managers are searching for in their entry-level employees.

"We want to get teachers out in the work world to try to find out what competencies are needed in the workplace,"

Estacado teacher Jeannie Coggins shows students some techniques involved in transporting a patient through the halls of a hospital.

Photo by Artie Limmer

Miller said. "We want to know how those skills are tied to the content that's taught in high schools."

Texas Tech's proposal was one of three, from a pool of more than 40, to receive funding to study the program from the Texas Tech-Prep Professional Development Consortium at Texas A&M University. The consortium acts as a subcontractor for federal grant monies generated under the Carl D. Perkins Vocational and Applied Education Act Amendments.

As a result of the grant, teachers of math, science, business and computer courses at Lubbock's Estacado High School were assembled in February to tour three local businesses — Texas Instruments (TI), Methodist Hospital and Lubbock Radiology Associates. Miller said the teachers chose Methodist and Lubbock Radiology because of Estacado's status as a magnet school for the medical profession. TI volunteered to participate after learning about the program.

During the on-site visits, the teachers observed and talked with workers on the job and became acquainted with today's technology and with managers' expectations of tomorrow's workers.

"We're really excited about what we learned," said Pam Thomas, a science teacher at Estacado.

Many of the workers, when asked if they use basic math skills in their jobs, initially replied that they did not. "After talking with them, though, we discovered a substantial use of all types of math — from the basics on up to the very complicated," Miller said.

"We found the extensive use of computers mind boggling," remarked Jay Driver, a computers and mathematics teacher at Estacado. "Computer terminals and personal computers were being used in almost every job function."

The teachers noted that managers and supervisors at all levels expressed the need for employees to be better skilled at quality control. "The employers want people who perform quality work and who can identify and solve problems in every aspect of the company — whether it's on the assembly line at TI or in the blood lab at Methodist," Thomas said.

The fact that Estacado's faculty stress being on time to class and handing in assignments is excellent, Thomas said. "But I see where more can be done in the classroom to relate all these skills to the outside world. Instead of simply awarding a grade of 'F,' we could give the unacceptable work back and ask the student to actually redo it for a grade. We also could have students checking the quality of each other's work, which is what happens in many job functions anyway."

The challenge of Tech-Prep is for teachers to pinpoint where this relationship between school curriculum and work skills can be formed. Miller said these informational tours are just the beginning of the process.

"We want to get teachers out in the work world to try to find out what competencies are needed in the workplace."

"Now we must examine how the program can be replicated and expanded to a larger scale within the Lubbock community," she said.

Miller will compile results of each participating high school teacher's evaluation of the program and by June 30 will submit her final report to Donald Clark, director of the Tech-Prep Consortium. These results will reflect the extent to which businesses will become active in helping teachers and students.

"For example, businesses could use the money they spend on new employee training and invest it in a high school program such as Tech-Prep," Thomas explained. "In many ways their money would be spent much more effectively."

Miller is satisfied with the initial success of Tech-Prep. Meantime, she is helping to define the parameters and roles for the local program.

"TI and Methodist invited all of our teachers and students to visit as a group anytime," she said. "Tech-Prep is striving to make students more academically powerful by incorporating skills they need for success in the real world."

Burga Jung, Ph.D., assistant professor of curriculum and instruction at Texas Tech's College of Education and consultant for the project, reiterated that this program is not intended to replace the liberal arts curriculum with a co-op type of program; rather Tech-Prep will complement and reinforce curricula in the standard subjects.

"These practical applications are meant to assist in the teaching and learning process and to help better prepare students to enter the work force," Jung said. "They are not meant to destroy the increasingly important value of traditional math, science and English skills. We want an academically focused program and still be able to make real connections with the working world outside."

Teachers said that making these connections are vital because the packaging of subjects like math becomes a major factor in students' learning processes.

"We have some students who, if you tell them to do 'math,' they will refuse," explained Driver. "But if I tell them that I need to order a certain number of cases of food, that the food should last a week, and based on our average consumption they need to figure out the proper amount to order — if I present it that way, they do it and do it well."

As Estacado recently has become a magnet school in the medical field, coach and math teacher James German related what the team of researchers and educators is trying to accomplish with these programs.

"If young basketball players have a coach who is hard and mean and really drives them, those kids are not going to enjoy the game and they are not going to play basketball later on. If you give young people a good experience — not necessarily teach them how to play, but just offer the basics and fun experiences — those young people will grow up liking the sport, playing it and eventually being good at it.

"I look at the medical program here in the same way. We're not teaching the students how to be doctors or nurses, we're just giving them good experiences so they more likely will pursue those professions later on."

And if the Tech-Prep program takes off, these teachers said they believe the good experiences they provide will be much more valuable as students enter the internationally competitive world of work. □

CROSSING BORDERS

Encountering the Links of Culture and Law in Guanajuato

By Jennifer LeNoir

The North American Free Trade Agreement (NAFTA) could impact the lives of countless citizens in Mexico and in the United States — from reduced trade tariffs to increased economic purchasing power and employment opportunities.

Whether or not NAFTA is ratified by Congress, students at Texas Tech University's School of Law already are preparing to play a crucial role in the world's changing global economy.

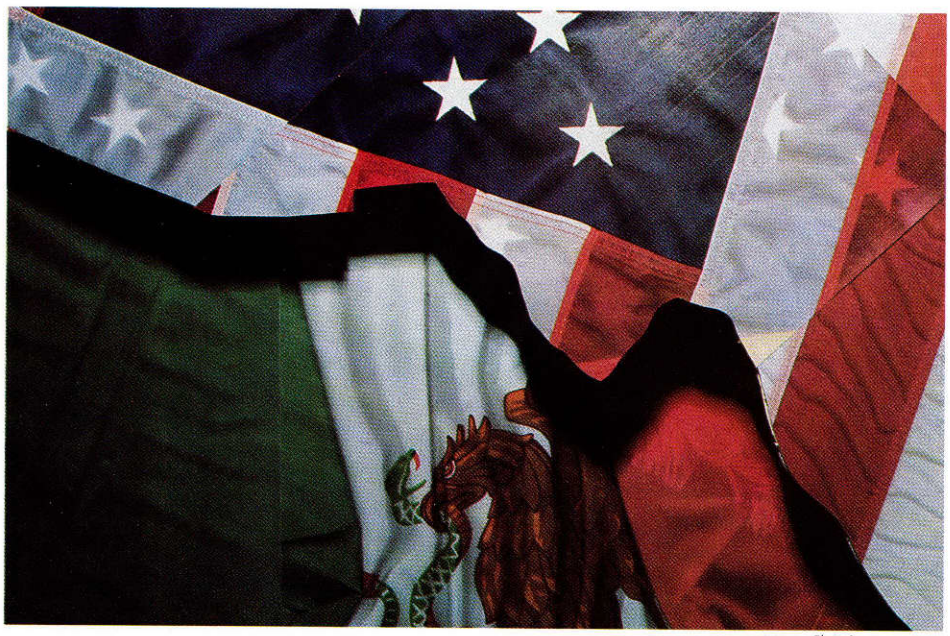


Photo by Artie Limmer

During the summer of 1992, the Texas Tech law school helped to establish a consortium of law schools that also includes the University of New Mexico, the University of San Diego and the University of Guanajuato. Called the Guanajuato Program, the consortium offers students from these schools, and other qualified students who attend American Bar Association-approved schools from throughout the nation, a six-week course of study each summer at the Institute on International and Comparative Law in Guanajuato, Mexico.

According to Bill Piatt, professor of law at Texas Tech, "Our location, our growing Hispanic presence on the faculty and in the student body, and an increased awareness of the importance of trade concerns places Texas Tech in a position of leadership in preparing attorneys for an increasingly international legal practice."

Because legal education traditionally involves focusing on precedent, students often are being prepared to fight "the last war" instead of being trained to confront the legal and economic realities of the future, Piatt says.

Although law school Dean W. Frank Newton and Piatt both agree that students need to learn to apply legal precedent, they also understand that students need to be prepared to deal with the realities of the future — and those realities undoubtedly will include increasing trade with Mexico.

Piatt, who is an Hispanic faculty member and graduate of the University of New Mexico School of Law, and Newton, a Del Rio native, who like Piatt also is fluent in Spanish, have shared their vision of establishing the program since 1988. They not only want students to learn about the Mexican legal system, they want students to have a broad-based understanding and knowledge of Mexico's rich history and culture.

As a result, the Guanajuato Program's curriculum is interlaced with lectures about Mexican society from the time of the Aztecs to the modern day.

According to Anna Perez, a third-year

law student from El Paso, "There are so many influences that directly contribute to conducting business in Mexico that are very different from the way American business transactions are done, which mainly are based on the principles of business administration."

For example, she says, that without an understanding of their political system, history, family structure and the Mexican psyche, even the best American attorneys could make major blunders when interacting in Mexico.

"I learned that if I want to work in the area of international law, I need to better familiarize myself with Mexican culture and heritage," said Perez. "I also need to learn how to better deal with the machismo aspect of the culture and learn how to get more respect so I can build trusting one-on-one relationships that are key to doing business effectively.

"The inequality for women is there, and if you're not prepared to handle it, then it can be a huge obstacle."

She said that the trip to Guanajuato was important to her because so many other American Hispanics have lost touch with their culture.

Scott Steinberger, a second-year law student also from El Paso, said he learned a great deal by living in the Mexican culture and experiencing firsthand how things are done. Listening to classroom lectures and learning about the cultural heritage of Mexico helped him to understand more about international and comparative law.

"The Mexican system of law is based on a civil system like in Europe and modeled somewhat after the French Napoleonic codes. The codes basically consist of more straightforward explanations of the law. As a result, very little legal interpretation is done by judges, and the real power is based in their political system and in their presidency," said Steinberger.

The primary difference in the United States is that the law is made by judges and, of course, by the legislatures, he said, but American judges are much more involved in the interpretation of the law.

Cheryl Crenwelge, a third-year law student from Fredericksburg, said that most significantly she learned that differences in one's cultural background influence how individuals are perceived by others.

"I decided to go because of the potential impact of the free trade agreement on the Texas economy and to travel and learn about another culture," she said.

Crenwelge, who previously had not traveled outside the United States, said the experience will help her to better deal with a variety of clients in her legal practice and to be more sensitive to everyone's cultural background.

A total of 70 students from around the nation participated in the program, with 17 from Texas Tech. All of the classes were conducted in English; more than half of the participating students could not speak Spanish.

"We still have a provincial notion that the United States can make it on its own economically — and we can't."

Although conversational Spanish instruction was available, the curriculum primarily consisted of six hours of electives that would qualify as credits at the students' law schools in the United States. Specifically, all students were required to take a three-hour course in Mexican law, history and culture. They could choose between taking courses in international business transactions or immigration law for their second elective.

Students were responsible for finding their own room and board, but according to Piatt, students could stay in a "nice" hotel and eat three meals for about $25 daily. He said some students found even better deals than that. Tuition cost each student about $1,000.

Piatt says that immersion is a very important part of the Guanajuato Program because students not only learn the law inside the classroom, they have an opportunity to socially interact with Mexican law students.

As a result, American students learned how the legal system worked and became aware of the perspectives of their Mexican counterparts. A great deal of learning took place in and out of the classroom, he said.

"To be a good attorney, you not only have to know the law, but individuals also must know something about the environment in which they practice law, such as its economy, politics and socialization," Piatt said.

Even before NAFTA was being discussed, Piatt said, ties have been growing between the United States and Mexico for some time. And the economy, especially in the border regions, has linked both countries.

If NAFTA is ratified by Congress, import and export tariffs will be reduced or eliminated altogether. That would mean, for example, that the price of orange juice would be reduced by more than one-third. Additionally, the $50 purchasing limit currently imposed on Mexican citizens when they cross into the United States will be lifted, resulting in increased retail sales and employment opportunities for both countries, especially in the border areas.

Overall, the agreement would mean more jobs in Mexico, a growing Mexican middle class, an increased purchasing power and a larger market place for manufactured goods produced in the United States.

Opposition to NAFTA exists, even in Mexico. Piatt referred to a Mexican cartoon that spells out the word Mexico, with the capitol "M" represented by McDonald's golden arches. The cartoon, he said, speaks to many Mexicans' fears about loss of culture and the negative image of becoming a "subsidiary" of the United States.

"We still have a provincial notion that the United States can make it on its own economically — and we can't," Piatt said.

"I think we are going to have an increasingly global economy. We would be really short-sighted to think that the United States can continue to sell products only in English and only to American consumers. Manufacturers in other countries realize that they can sell their products outside the country by marketing differently," he said.

By educating law students about comparative legal issues as well as about the cultural aspects of conducting business in Mexico, the graduates of Texas Tech's law school may help to lead the way in establishing positive business relationships with the neighboring country that could impact the economy of Texas and the surrounding border areas for years to come. □

As Nature Takes Its Course— Insects Lend Clues to Decaying Carcasses

By John Walls

Photo by Artie Limmer

Jack Hayes studies an insect as part of his research in forensic entomology, which can reveal possible times of death of humans and other animals.

Mention the word research to just about anyone and images of a sterile environment fill the mind. White lab coats, Petri dishes, goggles and a number of liquid solutions being poured from one beaker to another — that's research.

Jack Hayes' work, however, is more down to earth. Wearing a favorite cardigan sweater or long-sleeve shirt and peering over glasses, Hayes takes to the laboratory and the dusty, wide-open spaces with jars and other simple tools to inspect the world of insects.

By observing flies and beetles, Hayes, a professor in the Texas Tech department of preventive medicine, practices forensic entomology — hoping to provide crucial information that helps solve murders and answer questions surrounding previously mystifying deaths.

Entomologists study the life cycles and growth rates of insects. With that knowledge, a researcher like Hayes can narrow the possible times of death and disposal of a body.

Hayes, with a Ph.D. in health science from the University of Texas-Houston, acknowledges that the topic of insects being drawn to a decaying body seems morbid. But the work done in forensic entomology can be critical in serving justice and convicting the guilty.

"A lot of times, it just gives supporting evidence. But in some cases, it can pinpoint a time of death or can place an individual at the death scene," Hayes said.

Although forensic entomology is an emerging field, it has provided answers to law enforcement questions for many years.

Sung Tz'u, a Chinese death investigator, wrote in 1235 A.D. of a death by slashing in an Asian village. After questioning the town's farmers proved fruitless in solving the case, the local investigator had the villagers stand in a line with their sickles in front of them.

As the villagers stood motionless, flies eventually descended down on just one blade, attracted to the microscopic traces of blood and tissue. The surprised owner then broke down and confessed to the crime.

Hayes' work uses some of the same logic — just with more modern, scientific tools.

Hayes and his assistant, Jasmine Kelley, a 22-year-old undergraduate student in entomology, peer through microscopes, flip through temperature charts and crunch numbers on a computer to help analyze their data.

Volumes of books, piles of papers, numerous files and drawers line Hayes' office. Notes containing the physical characteristics of the latest insect subject lay next to a microscope — just across the table from some tools of the trade: tweezers and eye droppers.

Hayes has logged an extensive file on various High Plains insects, which are known to be attracted to carrion in various times of the year. More than 50 different species of insects and mites fill Hayes' collection.

"It's quite interesting," he said.

In one corner of the office is a fly collection that would make most small children green with envy. Flies are catalogued according to species and stages of growth, then mounted on a pin, safe and secure from possible scavenger beetles, thanks to the help of a few moth crystals.

One lab just down the hall — marked by a sign that warns "Do not spray for bugs!" — consists of a few jars of living flies. Hayes monitors the temperature and humidity in the room so he will have an idea of how the fly develops according to those environmental factors.

A fly reaches maturity through several stages. First there is the egg, then three larval stages, followed by the pupa stage where the adult fly develops and then emerges.

"By laboratory work, I know the

measurements of a specific species according to the period of time (since the fly's eggs hatched) and the temperature (in the surrounding environment)," Hayes said.

Knowledge of the insect world is so comprehensive that the number and kinds of insects that are attracted to a decaying body suggests how long the person has been dead.

"The earlier you are there, you can better determine the time of death, often to within six to 12 hours," Hayes said.

Insects also can offer other clues.

As an example, in one murder case, the remains of a grasshopper were found in the victim's clothing.

"And when they searched the chief suspect, it just so happened he had the rest of that grasshopper's leg in his cuff," Hayes said. "I mean, it was pure luck. But somebody knew to look."

In some instances, suspects have denied having been in an area when a crime was committed. But, in some cases, insects found in the grill of a suspect's car or in a suspect's possessions have clearly demonstrated otherwise.

"So sometimes you can go to a grill of a car and determine if a person would have had to go through a specific area to pick up those insects," he said.

Hayes has invested about 20 years in the world of entomology, spending much of that time in foreign countries researching the transmission of tropical diseases.

But a few bouts with malaria and traveling from country to country made Hayes decide to stay in the United States and put his knowledge of insects to work in the field of forensics.

"I can do this in my own backyard," Hayes said.

He's parlayed that past experience into being at the forefront of forensic entomology, starting his formal research in the fall of 1991.

Despite the fact that forensic entomology basically has existed for centuries, fewer than a dozen people are thought to be actively working cases in the field.

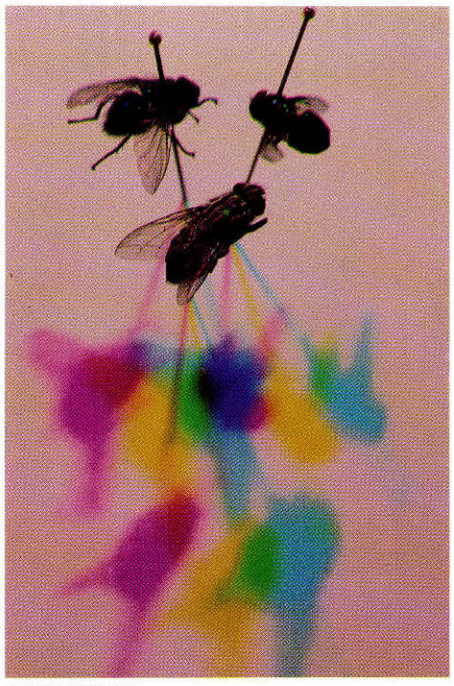


Photo by Artie Limmer

In one corner of the office is a fly collection that would make most small children green with envy.

Hayes spends much of his time literally in some of the High Plains grasses and fields.

He occasionally retreats to his South Plains range laboratory and a nearby shed that houses a bed for late-night research. He then will set his alarm clock for odd hours through the night to study his projects.

Hayes' research is performed on pigs who have had terminal diseases, such as cancer, or other conditions that make them unmarketable. Once a local pork producer has determined that a pig cannot be saved, the pig is offered to Hayes for research. That animal then is put to death.

After the animal is dead, it is staked out on the rangeland, and nature takes its course as insects are drawn to the decaying carcass as a source of nourishment. The carcass then is monitored on a regular basis by Hayes.

Hayes' research shows the natural deterioration of a body after death and determines what type of insects are drawn there over time.

"So the frequency and occurrence of insects on carrion is a very good indicator of the time of death," Hayes said.

West Texas law authorities recently consulted Hayes after finding the remains of a young woman, found buried south of Lubbock.

By examining the decaying body and the types of insects and their stages of development, Hayes determined that the young woman's body had been buried for about three weeks — limiting the possible time of death in the case.

Hayes has given seminars on forensic entomology to gatherings of sheriffs, department of public safety troopers and medical examiners. Such seminars are widely attended because few people know about the discipline, he added.

Hayes will spend a week this fall in Washington, D.C., as part of the staff for a Federal Bureau of Investigation school, educating law enforcement officers on the clues offered by decomposing bodies.

He mourns the fact, however, that little is known about forensic entomology in the nation's universities.

"Unfortunately, there are very few university courses even taught in forensic entomology," Hayes said.

The discipline, however, stays alive at Texas Tech University Health Sciences Center, where Hayes and Kelley constantly update their data and share their information with others.

Hayes is only too glad to take time out from his work and point out interesting traits of one insect to a visitor.

Kelley, meanwhile, continues to plug away at the computer and review various charts for her research. Such work makes good fodder for friends eager to kid her over her budding career choice.

"They think I'm the weirdest person in the world," she said. "I think forensic entomology is fascinating." □

Unlocking the Secrets of the Uterus

By Preston Lewis

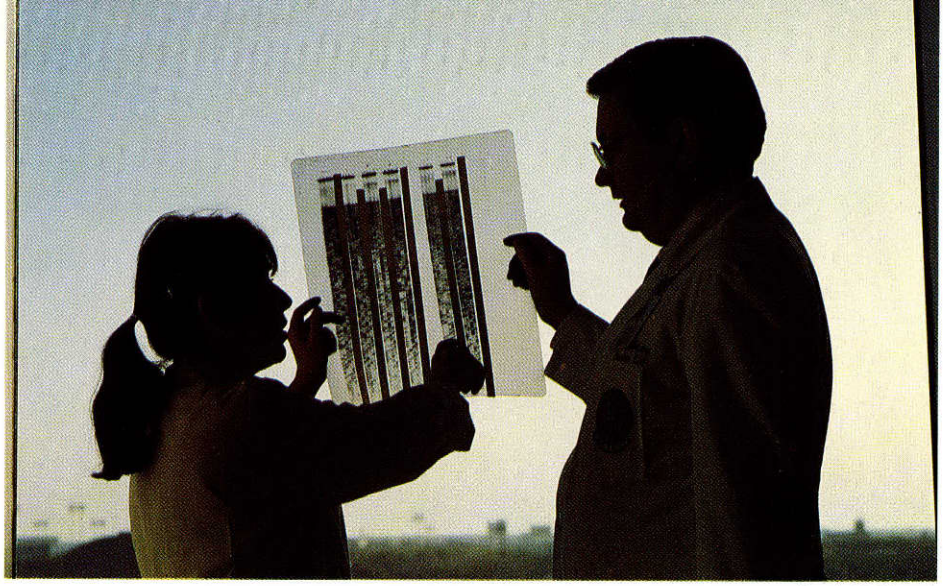


Photo by Mark Mamawal

Some studies suggest that the average couple has only a one in four chance of conceiving during any female cycle.

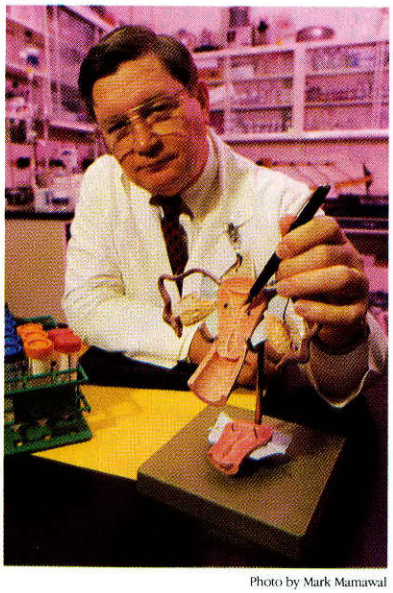


Photo by Mark Mamawal

Despite being the fertile crescent of all human life, the uterus remains a great miracle and an even greater mystery. The miracle is that this one organ — unlike others which are programmed to reject foreign tissues — will not only accept but also nourish a genetically dissimilar embryo.

The mystery is just what triggers the hormonal changes that suppress the female immune system and make the uterus receptive to a newly fertilized egg.

Biomedical researchers at the Texas Tech University Health Sciences Center are inching toward an understanding of this complex chemical communication between embryo and uterus. Whenever a breakdown occurs in the biochemical communication or its timing, the uterus becomes infertile.

"The uterus," said Texas Tech biochemist Kenneth L. Barker, Ph.D., "has to be properly primed by hormones so that it is in the right physiologically receptive condition for the embryo to implant and to grow in a normal fashion."

In fact, some studies suggest that the average couple has only a one in four chance of conceiving during any female cycle. Even when an egg is fertilized, it may be lost at menstruation, indicating that uterine factors play a significant role in infertility.

Barker is one of a group of researchers and physicians who are trying to shed light — and life — on those complex uterine communications. Barker, the center's vice president for research, and Harry Weitlauf, M.D., who chairs the cell biology and anatomy department, are studying the biochemical communications between the uterus and embryo at the cellular and molecular levels.

Top: Biochemistry faculty Sandra M. Whelly and Kenneth L. Barker examine DNA sequencing gels from their infertility studies. Left: Using a model of the uterus, Kenneth L. Barker describes the biochemical mysteries of implantation.

Infertility and reproductive endocrinology specialist Janelle Dorsett, M.D., and clinical embryologist Sam Prien, Ph.D., both of the obstetrics/gynecology faculty, head Texas Tech's infertility team that is giving couples not only hope but also babies who are truly miracles of medical research.

For more than a decade, Barker and Weitlauf have been heading a TTUHSC research and training program in reproductive biology to integrate research efforts with clinical applications.

"We are trying to determine," said Barker, "within the cells of the uterus the basic molecular events that are turned on and off to promote the cellular changes that prepare the uterus for fertilization and implantation of the embryo into the uterine wall."

Though medical science has been able to create so-called "test tube" babies through in vitro fertilization, the fact is that a fertilized egg will only survive outside the womb to about the 128-cell stage. Something about the uterine environment makes life possible. Consequently, in vitro fertilization techniques must deal not only with fertilizing the egg, but also with preparing the uterus to accept the embryo.

"The cells in the uterus become suitably prepared by cellular adjustments caused by estrogens and progestins," Barker said. "The levels of these female

Photo by Artie Limmer

sex hormones affect the environment so that the uterus can accept this foreign tissue."

These hormones regulate protein synthesis by entering the cell's nucleus where instructions for producing the protein are encoded on strands of DNA, the blueprint for all proteins in all cells. The hormones stimulate production of a messenger, RNA, which signals structures in the cell's cytoplasm to synthesize new proteins.

Barker's research has shown that an increased production of uterine hormones appears to be necessary for the uterus to change its environment enough to prevent rejection of the fertilized egg and to support it after implantation. These hormones stimulate not only the synthesis of these messengers from the nucleus but also the mechanisms synthesizing the new proteins in the cytoplasm.

"By knowing each step of this molecular process and knowing where hormones might activate this process, we may ultimately regulate levels of these uterine proteins that are required for implantation and influence function and cell division, both in normal and abnormal situations," Barker said. "If you know how that's done and you know how it's regulated, you can diagnose problems at the cellular level and possibly influence the biology of the cells in the uterus so an infertile woman could conceive."

While Barker is trying to understand the changes in the uterus, Dr. Weitlauf is studying the signals which the fertilized egg sends out as it nears the uterus. The uterus must recognize the fertilized egg and allow it to implant on the uterine walls where it can develop a placenta.

"Even after the uterus is prepared to accept a matured egg or a fertilized ovum," Weitlauf said, "the uterus has to become aware that there is one present to start the development of the mater-

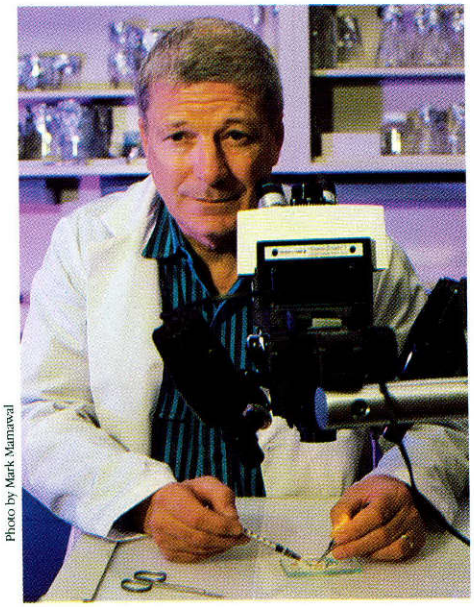


Photo by Mark Mamaval

Top: Janelle Dorsett (center) sits with former patients and some of the babies that the infertility team helped to conceive. Above: Harry M. Weitlauf studies how a fertilized egg signals the uterus to prepare for implantation.

nal side of the placenta. If that doesn't happen, the pregnancy will fail at that stage."

The fertilized egg apparently releases certain proteins which the uterus also recognizes as appropriate signals.

"We are looking at the signals from the embryo to the mother, trying to define chemically what they are and what controls them and whether some cases of infertility might be helped by being able to control these factors," Weitlauf said.

"This signalling mechanism involved in the implantation of the fertilized ovum is like tracing circles within circles," he said. "It's hard to focus on one piece of the mechanism but that's what we've been doing by very slowly taking this machine apart and finding its various segments."

Said infertility specialist Dorsett, "Implantation is the issue that we haven't solved very well because it's so difficult to investigate."

Though a variety of other factors, many of them simple to resolve, may be involved in infertility, implantation may well be the most complex piece of the reproductive puzzle and in vitro fertilization (IVF) is the last resort. IVF procedures require the retrieval of multiple eggs from a woman's follicles on the ovary. Those eggs are chemically prepared for fertilization then combined in the test tube with prepared sperm. Once eggs are fertilized, as many as five at the two- or four-cell stage are transplanted back into the mother's uterus.

Four or five eggs are transplanted into the uterus because that number seems to provide the optimum chance for a single pregnancy. Even so, the chances of an IVF pregnancy on any procedure are roughly one in three to four. However, women who try IVF procedures at least six times have a three in four chance of getting pregnant.

"Most of the time, though," Dorsett said, "couples just get too frustrated and quit. No doubt it's emotionally draining and it's expensive."

Minimum cost for an IVF procedure is $5,000, Dorsett said. Since insurance often does not pay for these procedures, the cost of six procedures can easily exceed $30,000. Because the costs are so great, having an early predictor of an IVF procedure's potential success can not only save a childless couple money but also reduce the emotional stress of another failed attempt at a child.

Working with Dorsett, Texas Tech embryologist Prien, who directs the IVF laboratory, has come upon a correlation which appears to be a strong indicator of the eventual IVF outcome. Prien measures progesterone levels at specified times in the clinical process leading up to an IVF procedure.

The amount of progesterone does not seem to be as important as the magnitude of the increase in the hormone measured by blood samples 12 hours before and 12 hours after another crucial hormone is administered to the patient. Women who undergo a threefold or greater increase in progesterone have an above average chance of becoming pregnant through IVF. Women whose progesterone levels increase between two and three times have only a marginal chance.

"Anyone with less than a twofold progesterone increase will have little chance of conceiving on that cycle," Prien said. "Predicting an unsuccessful outcome allows us to cancel the procedure early in the cycle. Then, it's not the emotional problem that an unsuccessful procedure is for the patients and it's not nearly as expensive."

This early indicator is providing results for couples participating in Texas Tech's in vitro fertilization program. While the success rate nationally for IVF procedures is 18 percent, Texas Tech's success rate has been hovering between 25 and 33 percent for the last three years. Further, the program has produced an unusual number of twin births, suggesting that the progesterone measurement is an excellent indicator for the uterus's readiness for implantation.

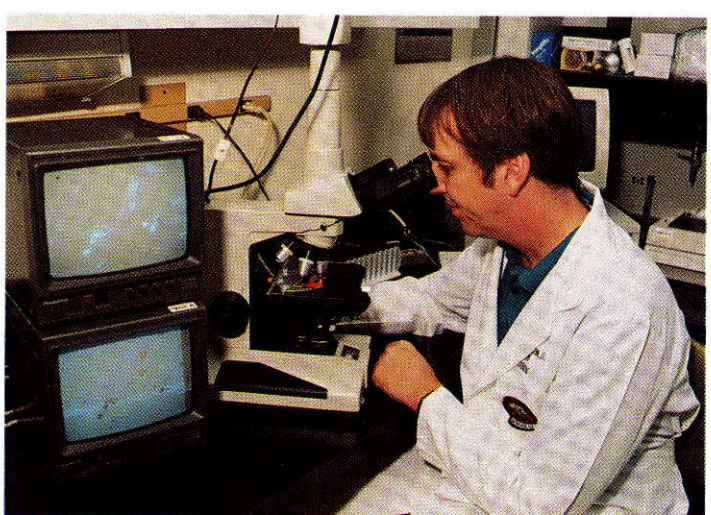
If progesterone levels indicate a good likelihood for a pregnancy, then the IVF team finishes the procedure. Dorsett surgically removes multiple eggs from the woman. Prien then prepares the eggs for fertilization in a specially designed lab that is maintained at body temperature and high humidity. Semen is collected four hours after the eggs are retrieved. After the sperm are isolated from the seminal fluid, they are combined with the eggs four hours later.

Once sperm have fertilized the eggs, Prien inspects them at the two-or four-cell stage to select five for implantation in the female. The remaining fertilized eggs are then preserved for further attempts at a later time.

Dorsett transfers the fertilized eggs to the uterus and the woman is given supplemental hormone shots. If the woman has not started a menstrual cycle within 14 days of the transfer, a blood pregnancy test is done. If a pregnancy is indicated, the woman returns two weeks later for an ultrasound evaluation. If everything is positive, she is referred back to her obstetrician for pre-natal care and delivery.

"It's quite frustrating at times," said Dorsett, "but I feel that if couples persist long enough you can help 75-90 percent of them conceive."

For those couples, their babies are not just miracles of life but miracles of science as well. □

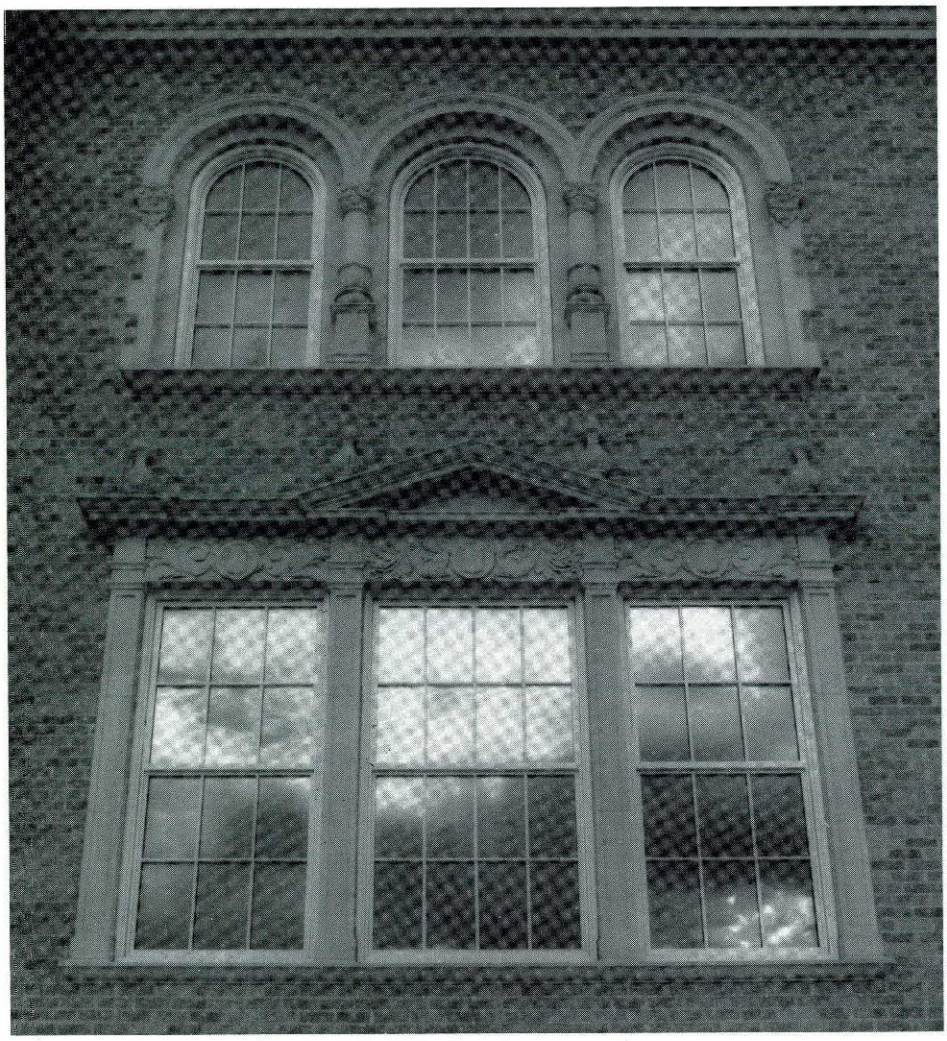


Sam Prien uses a computer assisted semen analyzer in his infertility laboratory.

Photo by Mark Mamawal

A Photographer's Gaze

Photos by Artie Limmer



Limmer appreciates the architecture of the Texas Tech University campus, as well as the light and shadows of the West Texas skies, in "The Windows of Education."

(Editor's Note: The graphic aspects — the angles, composition, negative space — are the stimulants in the work of Texas Tech University photographer Artie Limmer. He has been honored for his images by being named the National Photographer of the Year by the Council for Advancement and Support of Education, an international association of 3,000 colleges, universities and independent schools in the United States, Canada and Mexico. Limmer, photographic services manager and assistant director in the Office of News and Publications, regularly produces work for the university, health sciences center and other state and national publications, including Vistas. *Challenged to capture very diverse visual representations, Limmer says he most delights in experiencing moments of others' lives, grasping the many fascinations of human beings and their endeavors.)*

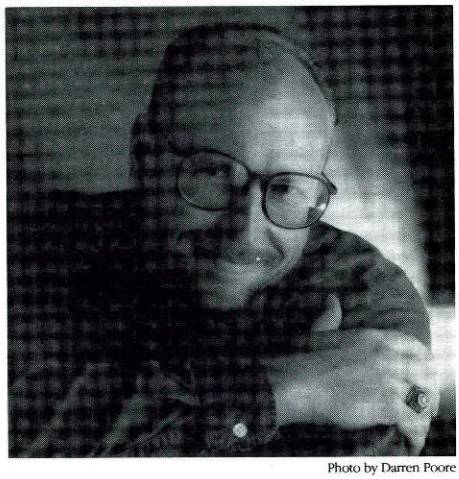
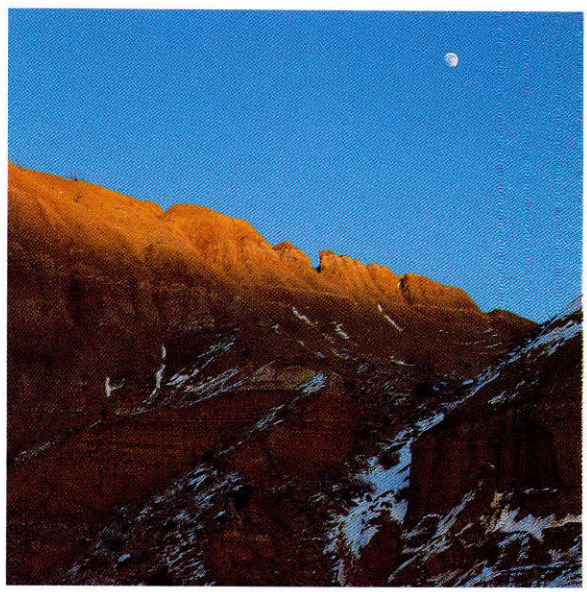
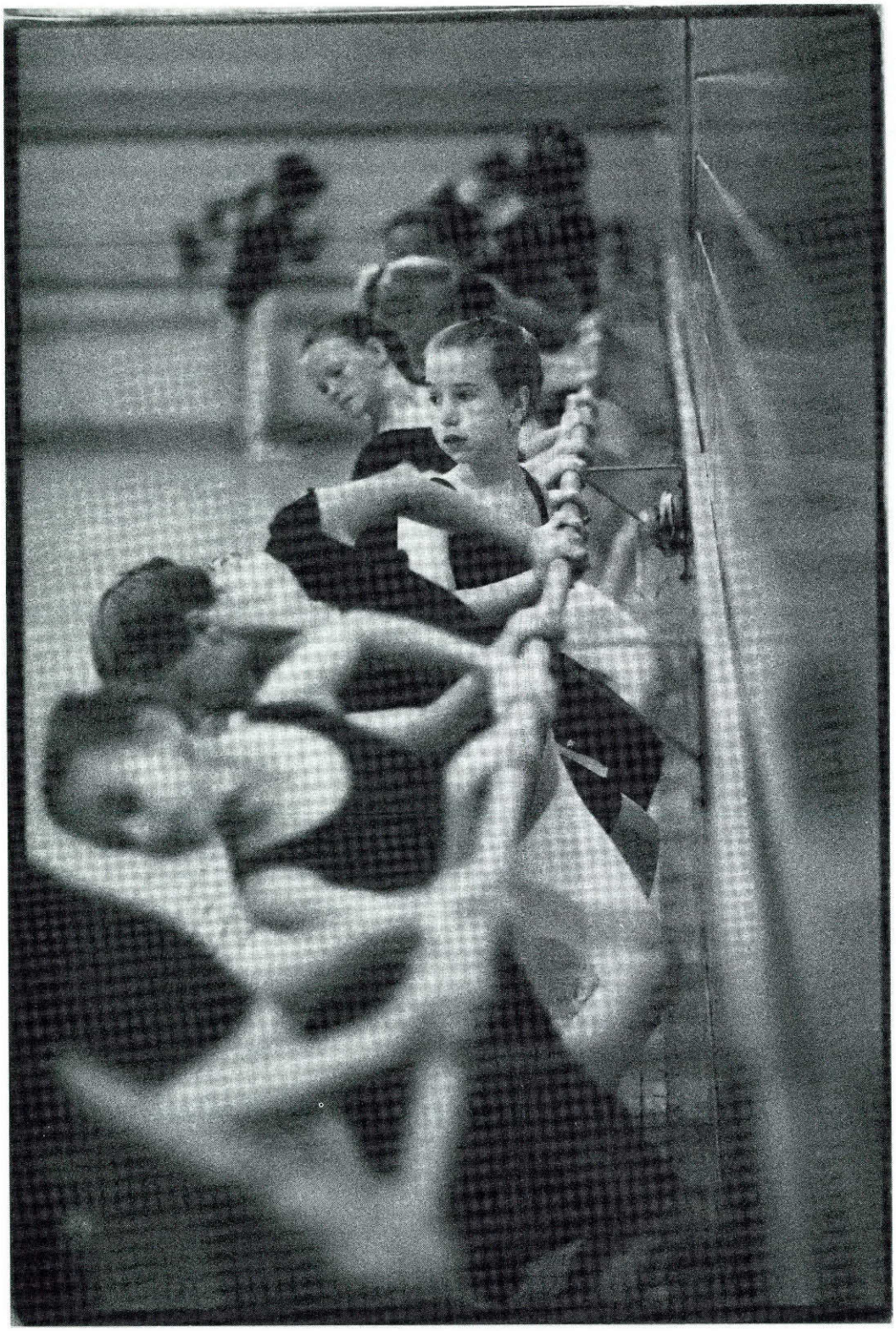


Photo by Darren Poore

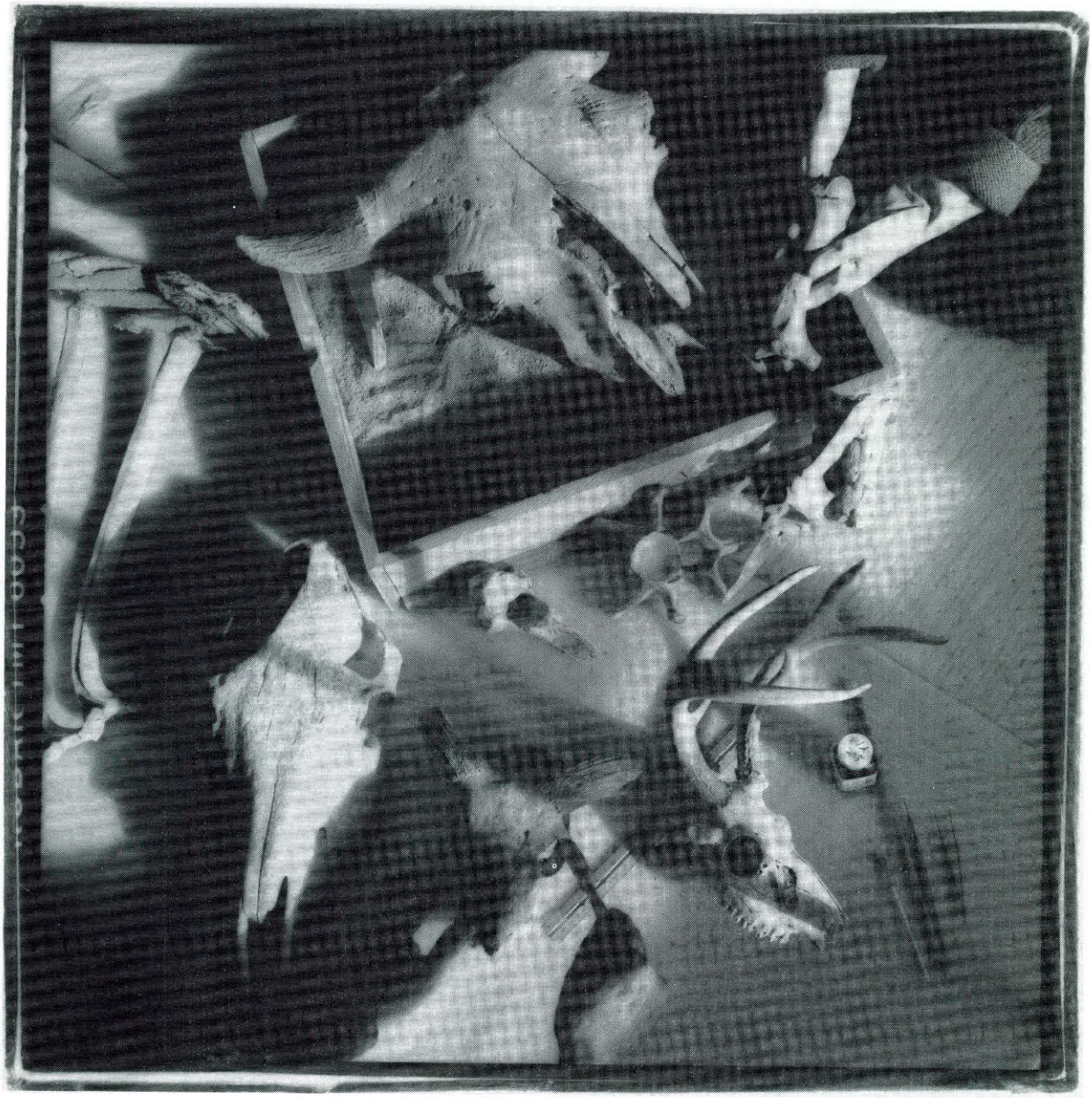
Above: Often exploring the trait of movement in his photographs, Limmer shows motion especially in his composition of the Texas Tech Masked Rider.

Right: Limmer seeks the most creative, unique and individual approach to portray even the simplest of scenes, such as a moonrise and sunset at nearby Palo Duro Canyon.



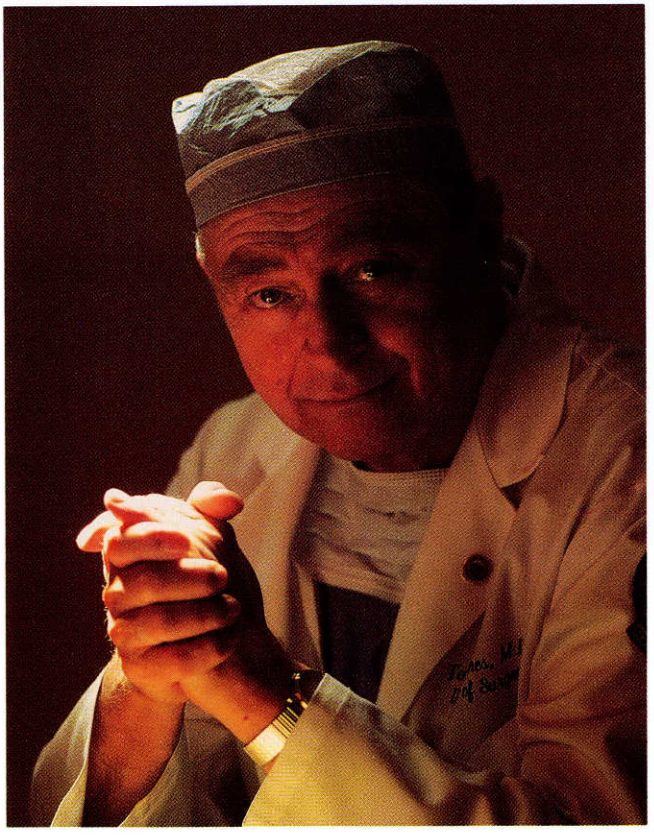


Varied assignments offer Limmer opportunities to create compositions in the studio and on location, of a still life or of people. Young girls practice the art of dance in "The Ballerina."



Limmer often creates a dream-like mood in a photograph, as seen in "Uncovering Ancient Bones," which shows some of the archaeological finds at the Lubbock Lake Landmark.

The radiance of one of the region's best characteristics, the coming and going of the morning and evening light, is reflected in "West Texas Violin."



Above: Limmer emphasizes the visual aesthetic pleasure of a musical instrument in his reflection of "The French Horn."

Left: In his favorite genre, portraits, Limmer attempts to reveal the interest, intelligence and confidence of individuals, as in "The Hands of a Surgeon," a photograph of G. Tom Shires, M.D.

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