SMU Research

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On the cover: Compounds developed by SMU Chemistry Professor John Buynak are among the products moving from SMU to the marketplace. See story on page 11.
The development of creative thinking is an integral part of university education, and research is both a facilitator and a result of that process. Rating systems such as those developed by *U.S. News & World Report* incorporate the quality of research conducted at a university, or the reputation resulting from that research, as one component. The classification system developed by the Carnegie Foundation for the Advancement of Teaching depends on research as well. The placement of a university in a Carnegie Foundation class is perceived as an indication of the level of ongoing research in that institution. Currently SMU is classified as a Doctoral I University—with 40 or more doctorates awarded a year in five or more disciplines. In the proposed system for 2000, it likely will be included in the Doctoral/Research Universities I classification—with 50 or more doctorates awarded a year across at least 15 disciplines.

The quality of research carried out in a university depends on the quality of faculty, students, and facilities. SMU recently has recruited some additional outstanding faculty, and one of the major objectives of The Campaign for SMU: A Time to Lead, begun three years ago, is the improvement of research and teaching facilities. Improved facilities help attract high-quality students, as well. The new Meadows Museum, to be completed in spring 2001; the Dedman Life Sciences Building, scheduled for completion in 2002; and the Jerry Junkins Electrical Engineering Building are a direct result of this effort.

The features included in this volume of *SMU Research* attest to the quality of ongoing research at SMU. The article on inventions and patents offers a glimpse into the commercialization process for SMU research and its value outside the University environment. This issue also highlights two of SMU's best researchers—art historian Annemarie Weyl Carr and Southwest historian David Weber. The shorter features describing the interests of several other faculty members illustrate the diversity of research on campus. The Research News, Sponsored Research, Faculty Recognition, and Faculty Publications sections all provide a picture of research vitality throughout the University.

We are grateful for your interest and encouragement, and we look forward to your continued support. Thank you.

U. Narayan Bhat

Dean of Research and Graduate Studies
Advertising and Ourselves

What do print ads really tell us about our culture and ourselves?

Advertising uses images of ethnic stratification, gender stereotyping, racial assimilation, and sexual violence to appeal to consumers, says Sociology Professor Anthony J. Cortese. His recent book, Provocateur: Images of Women and Minorities in Advertising, exposes how advertising images of women and minorities are manipulated to capitalize on current trends, often with disturbing results.

“Advertising’s goal is to grab our attention for a few seconds while it sells us a particular product or service,” Cortese says. “Advertising exploits our fascination with sex, violence, and the exotic to get our attention. Advertising plays with our values and tug at our emotions, often with unforeseen consequences.”

From pickups and blenders to perfumes and jeans, advertising depicts thin, beautiful women and lean, muscular men engaged in romantic, coercive, baffling, or other types of behaviors, fostering stereotypes and creating misconceptions about relationships and the nature of social reality.

“Children used to learn about life from parents, teachers, and other authority figures. Today’s children are increasingly picking up those lessons from those who only want to sell them something,” Cortese says. “Children and adults need to be more media literate so they can see through the stereotypes and hidden messages, and not allow advertising to script their behavior.”

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Virtual Reality Surgery

Engineering researchers at SMU are developing a device that someday may enable physicians to perform surgery without being present in the operating room or touching their patients.

Vildirim Hurmuzlu, associate professor of mechanical engineering and an expert in biomechanics, has created a device known as a haptic interface with the help of a team of graduate students. Haptic comes from the Greek word meaning “to touch.” The device resembles a mechanical arm, complete with a shoulder, an elbow, a wrist, and a partially completed hand.

Hurmuzlu says it will probably be a long time before surgeons operate on patients with a robotic
Clues in Clay

A piece of broken pottery is providing important clues to the domestication of plants and animals in northern Africa during the early Neolithic Period.

Catherine Nelson, a doctoral student in anthropology, has discovered what she believes is the oldest piece of pottery unearthed in the ancient Egyptian pottery samples brought to SMU before Egypt began requiring archaeologists to remain there for study and display. The nondescript gray piece of fired clay was found near Egypt’s Nabta Playa about 10,000 years ago.

Nelson, who is studying pottery from the world’s six oldest sites, has concluded that evidence of domestication often appears first with the making of pottery and not with the domestication of plants that have been domesticated. Discovery of this piece of pottery is important because it shows that the people who made it were engaged in gathering to survival by gathering and storing specific wild plants and animals in northern Africa during the early Neolithic Period.

The Blob, Part II

SMU geophysicists, using the latest in seismic technology, have discovered a large volume of unusually high-velocity matter deep within the Earth that may provide clues to better understanding of geological activities on the planet’s surface.

The anomalous matter, located more than 1,000 miles under the western Caribbean Sea, is about 80 miles thick by 380 miles long, almost vertical, and is believed to be slowly descending like the colored substance in a lava lamp. Scientists believe it may be an old subduction slab, but they are not certain how it moves.

Ileana Madalina Tibuleac, a postdoctorate researcher in the Department of Geological Sciences, and Professor Eugene T. Herrin made the surprising discovery while analyzing data gathered by sophisticated seismic equipment designed to detect underground nuclear tests.

Scientists have long believed that the Earth’s lower mantle (about 450 to 1,800 miles below the surface) was a homogeneous substance surrounding the Earth’s core. The discovery could provide clues about the composition of the lower mantle and the role it may play in seismic events close to the Earth’s surface.

Rock of Ages

A single rock collected by John Goodge has revealed some of the major geological events of the past three billion years. Goodge, associate professor of geological sciences, makes frequent trips to the rarely explored Transarctic Mountains in Antarctica, one of the oldest rock formations on Earth. On each expedition, he collects several thousand pounds of rocks to study and classify.

Goodge got a surprise while studying one of the rocks using a sophisticated probe that is able to date individual parts of a rock specimen.

“What is unique about this sample is that we have evidence for four events separated over two and a half billion years of time,” Goodge says. The events include the formation of what was to become Antarctica and the much later formation of the Transarctic Mountains.

The findings of Goodge’s research were published in the November 1999 issue of the journal Geology.
SMU physicists are participating in a research project they hope will provide fresh insights into the nature of matter, antimatter, and the formation of the universe.

Together with colleagues at Syracuse University and the University of Minnesota, SMU physicists helped build a new particle identification device for an electron-positron collider. Their effort is part of a program to study the fundamental interactions of quarks that involves 20 other North American institutions.

SMU’s portion of the project, headed by Physics Professor Thomas E. Coan and performed in Fondren Science Building, was to design and construct a large, novel form of a Cherenkov light radiator, a device that produces light when electrically charged subatomic particles pass through matter at speeds close to that of light. The characteristic pattern of the produced light is used to identify the particle.

By smashing streams of electrons and positrons together, the collider produces subatomic particles known as bottom quarks that can be used to examine differences between matter and antimatter. Matter and antimatter have the same physical properties but opposite electric charges.

“There are strong theoretical and experimental reasons to believe that the universe was created with equal amounts of matter and antimatter,” Coan says. “Yet, when you look at the universe today, the stars, planets, and people you see are all made from matter. The antimatter has disappeared. What happened to all the antimatter?”

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Dinosaur Dinners

Dinosaur skeletons unearthed in China three years ago by an SMU paleontologist are providing new clues into the eating habits of theropods, ancient carnivores whose diet has long been a source of mystery to scientists.

In an article published in the December 1999 issue of Nature magazine, graduate student Yoshitsugu Kobayashi says tiny stones found inside the rib cages of 12 ostrich-like dinosaurs called ornithomimids indicate they may have had gizzard stomachs that used grit to digest plant food, much like modern-day birds.

In modern birds, there is a clear relationship between diet and the characteristics of the grit they use. Meat-eating birds (carnivores) have no gizzard or grit, while fruit-eating birds (frugivores) use only a little grit and plant-eating birds (herbivores) retain more grit.

“The occurrence of gastroliths in these ornithomimids and the large number of stomach stones they contained are consistent with a herbivorous diet and the possession of a gizzard like that found in modern herbivorous birds,” Kobayashi says.

Ornithomimids lived during the Upper Cretaceous period from roughly 130 million to 65 million years ago.

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Sesmic Signatures

Brian Stump originally wanted to use seismic wave analysis to detect underground nuclear explosions. While developing more sophisticated instruments for interpreting seismic waves, Stump also has discovered more about the Earth.

Because seismic waves are useful, the Department of Defense has spent a lot of money placing seismographs all over the world," say Stump, a seismologist and professor of geological sciences in Deen College. "These instruments have opened the door for modern seismology and geophysics by enabling us to identify earthquakes of relatively small magnitude and to understand the structure of the Earth in more detail. As we began to make maps of tides, we began to understand plate tectonics and the idea that earthquakes occur along plate boundaries."

Stump's research focuses on the spread of seismic waves from explosions and natural geological events. He uses controlled mining explosions and earthquakes to study the Earth's structure, as well as the physics of an event that generates waveforms that are propagated worldwide.

His research has led to three important developments:

• Mathematical and theoretical models for representing the sources of seismic waves and some of their characteristics;
• Better understanding of high-frequency waves; and
• pinpointing the characteristics of waves generated by mining explosions and how they differ from earthquakes and underground nuclear explosions. Stump and other scientists are trying to ensure that small mining explosions are not misidentified as nuclear tests.

Stump's recent research focuses on the characteristics of explosions, including quantification of single-fired nuclear and chemical explosions and multifired chemical explosions commonly used by the mining industry. What he is learning about the spatial and temporal effects of mining explosions and their signature in regional waveforms has applications for monitoring a Comprehensive Test Ban Treaty where even small explosions will be identified using their seismic signatures to ensure compliance.

Stump received his Ph.D. from the University of California at Berkeley. He joined the SMU faculty in 1983, and is a member of the Air Force Technical Applications Center Seismic Review Panel. He served as scientific adviser to the U.S. delegation to the Conference on Disarmament in Geneva, Switzerland, from 1984 to 1996 and has been a consultant and staff member at Los Alamos National Laboratory.

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Stump and other scientists are trying to ensure that small mining explosions are not misidentified as nuclear tests.
Setting the Standard

Thanks to the work of Someshwar Gupta and his SMU graduate students, phones may not be used only for talking anymore. Gupta, the Cecil H. Green Professor of Engineering, is contributing to the development of standards for broadband wireless services that will transform the voice-only cellular telephone into a mobile communication device with multiple functions.

The standard Gupta is helping develop is called Wide Code Division Multiple Access, or WCDMA. It will enable voice, text, the Internet, and even movies to be sent through cellular phones. Standards help the world's 470 million wireless users to communicate with one another without a lot of interference.

Broadband can accommodate more voice traffic along a network than the limited bandwidth now in use, Gupta says. The technology, however, becomes more complicated when more voice data is sent.

"With different kinds of services, you need different rates at which data is sent. One person could be talking, another could be receiving a fax, another could be receiving stock quotes, and another could be sending pictures — all at different rates. The question is, how do we develop a standardized procedure that can handle all the different rates?" Gupta says.

His experience researching wireless communication stretches back almost 20 years, when the U.S. Air Force Office of Scientific Research gave him a series of grants to solve problems found in the emerging technology. Today he receives most of his support from wireless communication companies such as Raytheon Telecommunications Systems and Ericsson Inc., which has awarded several grants to support a team of Ph.D. students researching problems associated with WCDMA.

"Ericsson has been supporting me for five or six years, and every couple of years it changes the nature of the problem. I enjoy working on problems that have meaning and will advance practical uses, but that also require very advanced mathematics, probability theory, and electrical engineering to solve," he says.

Gupta joined the SMU School of Engineering and Applied Science in 1967 and served as chair of the Electrical Engineering Department from 1982 to 1988. During his 30-year career, he has supervised more than 60 Ph.D. dissertations, written three books, and published more than 100 journal articles. Recently he was named a Fellow of the Institute of Electrical and Electronics Engineers (IEEE), one of the highest honors bestowed upon an engineer. Gupta received his Ph.D. in electrical engineering from the University of California at Berkeley.

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Net Impact

Alan Albarran has always been interested in the business side of media. With the growth of the Internet, he has turned his attention to the impact of this new mode of communication on business and society.

His studies focus on the three types of electronic commerce conducted on the Internet — business to business, consumer to business, and consumer to consumer.

"Electronic commerce on the Internet is growing at a phenomenal rate, much faster than originally anticipated," says Albarran, professor of electronic media and film and associate dean of Meadows School of the Arts. In 1999, $68 billion in sales was transacted over the Internet. By 2002, annual revenues from electronic commerce are projected to be as high as $1.2 trillion.

"There is considerable consensus that the Internet economy will outpace the global economy over the next decade," Albarran says. The economic growth potential of electronic commerce raises expectations that every type of business can make money via the Internet. However, Albarran says reality suggests otherwise. "Right now the only industries making money off the Internet are travel, financial services, and pornography," he says, adding that only 5 percent of online efforts were expected to be profitable in 1999.

Although the Internet represents a new market for commerce, Albarran says, it is important to recognize that electronic commerce involves relationships, not only revenue transactions.

"The buying and selling of goods and services, whether transacted between consumers and businesses or businesses and businesses, is still driven by people," he says. "The virtual economy will be no different because it will demand strong customer service and value. In turn, customers who receive good service and value will exhibit greater brand loyalty."
Manufacturing the Future

To walk inside the SMU Research Center for Advanced Manufacturing is to view the future of manufacturing engineering. Located in Richardson's high-tech corridor, the center is advancing product development using new materials and manufacturing processes.

Radovan Kovacevic, the Herman Brown Professor of Materials and Manufacturing Processes in the School of Engineering and Applied Science, oversees faculty members and Ph.D. students who are researching and developing conceptual products using some of the most advanced manufacturing methods available.

The center's most promising research is in the area of rapid prototyping and manufacturing. Kovacevic says. In rapid prototyping, three-dimensional models of parts and tools developed by computer-assisted design (CAD) are created out of plastic, paper, or wax. However, SMU researchers use high-powered laser and gas metal arc welding to make structurally sound functional parts, molds, and dies. The technology also is called solid free-form fabrication.

Kovacevic is one of the first researchers nationwide to use rapid prototyping to make metallic parts and tools from a hybrid of gas metal arc welding and precision milling. In doing so, he is creating prototypes that not only have the geometry of the finished product, but its mechanical and metallurgical properties as well. In some instances, his method is the only way to produce the complexity found in real parts, such as conformal channels for cooling and heating, in molds. He can prototype parts and tools using a variety of industrial metals such as super alloys, stainless steel, and tool steel.

"The advantage of this method is that it eliminates several steps in the fabrication of metallic functional parts, thus reducing the crucial lead time between designing a product and bringing it to market," Kovacevic says. "This can give a manufacturer an edge over its competitor."

The holder of two U.S. patents, Kovacevic has published more than 260 technical papers and five books. Before coming to SMU in 1997, he was a professor of mechanical engineering at the University of Kentucky. He has taught and consulted at universities in China and Europe. Kovacevic is a fellow of the Society of Manufacturing Engineers, a Fulbright Scholar, a Duisburg Scholar, and a Humboldt Scholar.

He received his Ph.D. in material science from the University of Montenegro, Yugoslavia.

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Helping the Disabled Do Math

"Difference of two squares.
"Difference of two cubes.
"Binomial formula.
"Quadratic equation.
"Difference of two cubes.
"Binomial formula.
"Quadratic formula.
"3-D wave equation.

As Henry "Buddy" Gray speaks, complicated mathematical formulas appear on his computer screen, almost as if by magic.

Gray, the C.F. Frensley Professor of Mathematics and Statistics in Dedman College, has developed the first computer software that can convert voice commands into mathematical expressions. Although other researchers have developed voice-recognition software that generates words, Gray is the first to develop a means to generate complicated mathematical equations. His software can type virtually any mathematical symbol and equation.

Gray's software has three versions. One version, called MathTalk, can be used by professional mathematicians as well as college students who are unable to use a keyboard. A version called MathBrailleTalk can be used by visually impaired students. This version translates mathematical formulas into Braille, which can then be output using an embosser. It also will echo or read aloud any mathematical expression entered by voice.

Gray also created a grade-school version of MathTalk called ArithmeticTalk, which can be used by children in grades 1 through 5.

Gray, a former dean of Dedman College, began to develop the software three years ago just to help himself and his secretary. He taught himself the computer programming necessary to write the more than 1,000 pages of code that runs each program. He also learned Braille to develop the MathBrailleTalk program.

Metroplex Voice Computing of Arlington, Texas, has copyrighted Gray's programs and is marketing them to school districts, community colleges, and universities.

Gray was chairman of the Department of Mathematics at Texas Tech University before joining the SMU faculty in 1973. He earned both Bachelor's and Master's degrees from Texas Tech and a Ph.D. from the University of Texas at Austin. His other research interests include developing data analysis techniques and problems associated with monitoring nuclear tests. He also is developing a methodology to detect heart disease from acoustical data obtained through newly developed sensors. He has written more than 75 articles on applied mathematics, statistics, global warming, and nuclear monitoring.

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The Internet and the Law

Since the Internet was opened to commercial use in 1995, it has had a tremendous impact on the way business is done worldwide. Jane Kazdan Winn, associate professor in SMU School of Law, is one of only a few researchers in the country studying the impact of e-commerce on commercial law— and on the legal profession.

"One of the most interesting things about e-commerce is the degree to which lawyers may become increasingly irrelevant if the technology works as intended by its designers," Winn says. "This has very profound implications for what attorneys should be doing in law school and what they should be doing in law practice, because some traditional areas of law practice may become much less important."

For example, Winn explains, tens of billions of dollars of com-
comparative law and general business law, which covers such areas as automated commercial transactions. She also worked as a stockbroker before earning her law degree from Harvard Law School.

Winn is co-author of the treatise *The Law of Electronic Commerce* (1998) and has published numerous papers on different issues relating to the law of electronic commerce.

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Mechanization and the Middle Ages

Bonnie Wheeler steps back in time to the Middle Ages every day to illuminate such issues as gender, heroism, and chivalry through her scholarship and her teaching. Although her research spans from the origins of the legend of King Arthur in the sixth century to the heroism of Joan of Arc in the fifteenth, Wheeler contends that her discoveries offer students valuable insight about their roles in society today.

"We presume that gender is a contemporary concern, but the first thing people always ask about a healthy baby is, 'Is it a boy or a girl?'" says Wheeler, associate professor of English. "I'm interested in how gender formation takes place across cultures and time. Until recently, we've known very little about women in the Middle Ages, but we've also known just as little about male role formation in that period."

Wheeler, who serves as director of SMU's Medieval Studies program in Dedman College, has spent the past 25 years researching gender roles in the Middle Ages, focusing on such significant figures as the Abbess Heloise, Abelard, and Joan of Arc. She also writes about literary representations of heroism in the Middle Ages.

Last fall Wheeler, who frequently appears on the History Channel and A&E Network, discussed Joan of Arc on a History or Hollywood program. "Joan of Arc was the quintessential military hero and ultimate political victim. Her story is one about love for her country only as much as it is about her love for God. It forces us to consider questions of spirituality, something that intellectuals (as professional skeptics) often find embarrassing."

As general editor for the book series *The New Middle Ages*, Wheeler has edited *Feminea Medievalia I: Representations of the Feminine in the Middle Ages; Medieval Mothering; Fresh Verdicts on Joan of Arc; Becoming Male in the Middle Ages; and* most recently, *Listening to Heloise: The Voice of a Twelfth-Century Woman.*

Wheeler also serves as editor of *Arthuriana*, the quarterly journal of the International Arthurian Society—North American Branch. The journal maintains a Web site at dcs.smu.edu/Arthuriana/.

"Stories of King Arthur are often thought to be utopian, but I argue instead that these stories maintain a vivid, hopeful— even heroic—idea of society and politics in spite of inevitable human frailty," Wheeler says. "These stories are often beautifully crafted, and I am drawn to their beauty as much as to their insight."

Wheeler, who joined SMU in 1975, previously taught at Columbia University and Case Western Reserve University. At SMU she has received numerous honors and grants, including the Outstanding Teacher Award, the Perrine Prize of Phi Beta Kappa for excellence in scholarship and teaching, and SMU Research Council grants, among others. She received her Ph.D. from Brown University in 1971.

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Andrew Chen likes to think of himself as a “financial engineer.” Chen, distinguished professor of finance in Cox School of Business, studies how businesses and governments can reduce their risk exposures and improve their bottom lines by making better use of financial resources.

For example, Chen says, financial engineers have been able to help banks greatly reduce the cost of making transactions. Previously a bank transaction using a teller cost an average of $1.27, Chen says. “If customers use an ATM machine, that transaction costs only 27 cents. If they use online banking, it is only one cent.”

As a result, Chen says, major commercial banks now offer their customers online banking services free of charge – providing better service to their customers and reducing their operating expenses at the same time.

Corporations use financial engineering to reduce financing costs or hedge their exposure to currency price risks, Chen says. For example, in the past a corporation may have issued stock to raise money. Today, they could arrange a loan through a foreign bank and save hundreds of thousands of dollars as well as the time-consuming process of registering with the Securities and Exchange Commission (SEC), he says.

Careful applications of financial engineering also can help governments raise funds at lower costs. For example, governments can issue inflation-indexed bonds to reduce their costs of borrowing by not paying inflation premiums, or can issue “puttable” bonds that guarantee a certain return, thus lowering the risk for investors.

Financial engineering techniques also can be used to provide solutions to numerous problems that have plagued large-scale public infrastructure projects in emerging nations, Chen says. He suggests that financing of such projects should be privatized to eliminate the bribery, corruption, and inefficiency that often occur when politicians handle the financing.

Financial engineers in all sectors use derivatives, which can provide high rates of return, but are also very risky if used incorrectly. Chen specializes in studying the growing market for derivatives – and some of the financial disasters that have resulted from their use. In 1994, for example, Orange County, California, lost $1.64 billion from some speculative high-leverage investment strategies.

Chen’s analysis of recent derivative debacles indicates that most are caused by lack of knowledge about derivatives usage among senior managers and lack of internal control systems in many banks, corporations, and governments.

“Collaboration among universities, corporations, and governments is essential to train well-qualified financial engineers,” Chen says. “Good financial engineers should have a thorough understanding of advanced mathematical concepts, as well as the financial and computational tools required for the design and application of financial derivatives.”

Chen joined the SMU faculty in 1983 after teaching appointments at The Ohio State University, the University of California at Berkeley, and the State University of New York at Buffalo. He received his Bachelor’s degree in economics from the National Taiwan University and received a Master’s degree in economics and a Ph.D. in finance from the University of California at Berkeley.

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Several SMU researchers have made discoveries with commercial potential. While working as an antenna engineer for Hughes Aircraft Company, Choon Sae Lee wanted to develop a better antenna for the booming field of telecommunications. It was not until he joined the SMU faculty in 1989, however, that Lee had the opportunity to pursue research in this area.

Supported by several grants from the Texas Higher Education Coordinating Board’s Advanced Technology Program, created by the Texas Legislature to fund research on technologies with potential for commercial application, Lee has succeeded in designing a new form of antenna that could revolutionize the wireless communications industry.

Lee, associate professor of electrical engineering, has developed a flat antenna about 10 inches square that could replace the large, dish-shaped antennas now used to receive satellite television signals. “We’re trying to replace the existing market with something that is better and cheaper,” he says.

The antenna, known as a microstrip antenna, could cost much less than conventional reflector antennas because it can be mass-produced instead of assembled, Lee says. Its small size is more aesthetically pleasing, and the antenna can withstand harsh environments better than conventional antennas.

SMU received a patent on Lee’s basic antenna design in 1998, and the University has signed a licensing agreement with Crest International in Fort Worth to manufacture direct broadcast satellite television
Board of Trustees approved the establishment of a company with RCT to develop and test Buynak's compounds. This is the first such company SMU has formed. "This work should succeed, unless we get very different answers when the compounds are tested in animals and humans," Pyron says.

Buynak received a $102,594 grant from the 1999 Texas Advanced Technology Program to continue his work on beta-lactamase inhibitors.

Zeşayep Çelik-Butler, professor of electrical engineering, and Donald Butler, associate professor of electrical engineering, have developed another technology that RCT believes will be of great interest to the marketplace.

The Butler's breakthrough technology enables the creation of lighter, cheaper, and more sensitive devices to detect infrared radiation. The technology has numerous consumer applications, including night vision for automobiles, the development of burglar alarms, and equipment that could detect fires or monitor air pollution.

For example, products based on this technology could be used by firefighters to find the "hot spots" in a burning house or to determine whether there is a raging fire behind a closed door. It also could be used to locate people more quickly.

"Smoke obscures your regular vision, but infrared light can penetrate the smoke," Donald Butler explains.

Or, instruments could be developed to detect forest fires long before any other means. "For a very small cost, a station could be set up to monitor a large area of forest," Butler says.

SMU has received four patents on the Butler's technology. In the meantime, the Butlers have received a grant from the Natural Science Foundation, Texas Instruments, Raytheon Systems Company, TriQuint Semiconductor, Marlow Industries, and Isonics.

SMU is seeking funding to make the interface with the simulation algorithm user-friendly so that it will have more commercial value. To date, Raad has received support for his work from the National Science Foundation, Texas Instruments, Raytheon Systems Company, TriQuint Semiconductor, Marlow Industries, and Isonics.

Raad also directs a lab called the SMU Submicron Electrothermal Sciences Laboratory, in which he can measure the thermal properties of thin-film materials used in integrated circuits.

"The properties of many materials are different when they are in a thin-film form," Raad explains.

Several Dallas-based companies use Raad's lab to test new materials or new ways of using old materials. The lab also can determine the reliability of materials and systems.

David Matula, professor of computer science and engineering, also has created a product that may be of value to the booming telecommunications industry. Matula has developed a method of handling and assigning calls within a cellular phone system that has the potential to increase the system's load-carrying capacity by 10 to 15
Chemistry Professor

John Buynak has created a new class of compounds that can effectively treat penicillin-resistant infections.

P&G's increased market share during the Christmas season could be applauded, despite the fact that the company has been under scrutiny for its advertising practices.

The push to commercialize inventions has several downsides, however. One is the initial cost. “Many people think intellectual property is a way of generating money, and it can be,” Smith says. “But it also costs a whole lot on the front end.”

Smith estimates it costs from $10,000 to $20,000 to receive a U.S. patent. “International patents are much more,” he adds.

In addition, the time needed to perfect a product for market is time taken away from other research. “Researchers have to make a choice about how they spend their time,” Smith says. “If they are doing developmental work, they are not doing discovery research.”

The process of bringing products to the market also can be long and frustrating. “One of the big myths about intellectual property is the old saying that ‘if you invent a better mousetrap, the world will beat a path to your door,’” Smith says. “Nothing could be further from the truth. The world doesn’t care if you invent something. You have to market that invention, sell it, and convince people that it is an advancement in technology that is worth adopting. People are reluctant to change what they already have an investment in.”

Overall, however, Smith says he believes the effort to bring new technology to market is worth it. “If faculty members at SMU and elsewhere weren’t doing this type of work, we wouldn’t have all the products we have,” he says.

PROFITING FROM PATENTS

The sports drink Gatorade. the anti-cancer drug Taxol, and the technology used in DVD players are only a few of the beneficial—and profitable—products developed by university research labs.

According to The Chronicle of Higher Education, colleges and universities in the United States collected more than $76 million in royalties from inventions licensed to industry in fiscal 1998. The University of California System topped the list. with its campuses earning more than $57 million.

Columbia University, which patented the digital-compression technology used in DVD players; Florida State University, which patented Taxol; and the University of Florida, which patented Gatorade, are among other schools at the top of the royalty list.

The University of Wisconsin became the first university to pursue licensing when it formed the Wisconsin Alumni Research Foundation (WARF) in 1925 to commercialize Professor Harry G. Steenbock’s discovery of how to use ultraviolet radiation to produce vitamin D in milk. Today, WARF has more than 600 discoveries available for licensing to companies throughout the world, including a pharmaceutical compound that diminishes the symptoms of multiple sclerosis and a method for monitoring the immunological status of transplant recipients.

SMU also hopes to capture a piece of each royalty. It established an Office of Technology Development in 1996 under the direction of Larry Smith. The office screens inventions and discoveries for patentability. commercial potential, and general marketability; supports the filing of patent applications; maintains a list of technologies available for licensing; and negotiates licensing arrangements with interested companies.

Narayan Bhat. dean of research and graduate studies, is pleased with the progress SMU has made in only a few short years. “For a school our size, we are doing very well,” he says.
By Deborah Wormser

David Weber's father, who owned a furniture and appliance store in Buffalo, New York, considered his son's career choice a big mistake.

"He told me about salesmen who came to his store and had history degrees," Weber remembers. Ironically, a secret to success in retailing appears to be one that Weber took to heart in his work: location, location, location.

Weber, director of the William P. Clements Center for Southwest Studies and the Robert H. and Nancy Dedman Professor of History, has become one of the leading scholars of U.S. borderlands history, particularly the impact Spanish settlers had on Native Americans in the Spanish colonial period. Borderlands history looks at the confluence of cultures — including English, French, Spanish, Mexican, and Native American — in a region once considered too far out of the mainstream of U.S. history to warrant attention.

Weber has written or edited 20 books and more than 50 scholarly articles on the history of the southwestern United States. His nationally acclaimed book, *The Spanish Frontier in North America*, which was named one of the "notable books" for 1992 by *The New York Times*, is considered the yardstick against which other books in the growing field of borderlands research are measured.

"David Weber is surely the leading scholar of the Southwestern borderlands of his generation; indeed, he ranks with Herbert Eugene Bolton, who founded the field of borderlands history, as one of its pre-eminent practitioners in this century," says William Cronon, the Frederick Jackson Turner Professor of History, Geography, and Environmental Studies at the University of Wisconsin-Madison.

Only a scholar as balanced as Weber could lead the field in reinterpreting some of the nation's most dearly held myths about its history. This includes a re-evaluation of Bolton's work which "as a part of an early 20th century Yale series that boasted the motto, "Let us now praise famous men." Where once U.S. historians focused on the actions of famous Anglo-American men in state and national capitals, Weber helped lead the shift in emphasis to the actions of everyday men and women of many races.

"I felt that the scholarship on the frontier was too Anglocentric, too one-sided..."
avid Weber Carves a Niche as Leading Borderlands Historian

When you look at it from Albuquerque or the
then Rocky Mountains," Weber explains. His first
book, *The Taos Trappers: Fur Trade in the
Swiss Northwest*, grew out of that feeling.
Earlier historians cast the Anglo-Americans
as land seekers, the Spaniards as land
savers because they could not hold the territories
North America. Those historians focused
the Anglo-Americans of the 1820s and
30s as heroes coming from the East in
search of beaver in the West, which usually
is depicted as a vast open space. In reality,
Mexico extended to the northern boundar-
ies of what is now California, Utah, and
Colorado and included the Rocky Mountain
region, which made the "West" part of
Mexico. From that perspective, the Anglo-
Americans were illegal immigrants and
thieves depleting a Mexican natural
resource: beaver.

"I like to take what is familiar and make it
ange to put Anglo-American trappers who
treasure trove of every conceivable
imprint on Western Americana and much of
Mexico," he says. Libraries in Chicago and
California may rank higher in handwritten
manuscripts, but DeGolyer's holdings in
maps and photographs (400,000 items) and
rare publications - such as the pamphlet
containing a letter Columbus wrote about
his impressions of the New World that was
printed when he returned to Spain - can
stand up to any other collection.

The Clements Center, which Weber
directs, publishes new editions of some
of the DeGolyer's most noteworthy
books and recent SMU scholar
ship. Again, Weber is at the vanguard, using high-tech,
"printing on demand" techniques that many
trade publishers would envy.

These techniques enabled the publica-
tion of the Center's recent book on Picuris
spoken by many people, and there were
Native Americans."

The only passions to be found in Weber's
work are those for detail and accuracy,
reflected in the nearly 200 pages of footnotes
and lists of resource materials included in
*The Spanish Frontier*, which took five years
to write. His exhaustive research corrected
the errors of earlier historians about who
discovered the Mississippi River (Alvarez de
Pineda, not Hernando de Soto or René La
Salle) and set straight a popular, but wrong,
notion that Spaniards went to the New
World to plunder, while the English and
French came to settle and trade.

"David is a scholar's scholar," a historian's
assistant the Enterprising said. "He
shows a commanding understanding of the broad
swEEP of the historiography to produce sub-
tle, nuanced interpretations that are so even-
handed and fair-minded that they command

Weber is working on a new book,*
Saman's and Their Savages in the Age of
Enlightenment*, which looks at Spanish
relations with independent Indian groups
in North America, Central America, and
South America from 1750-1812. He is
attempting to place North America more
likely in context as part of a larger empire for
which Spain had to commit resources and
unnecessary. That picture, he says, did not
merge clearly in his prize-winning book.

"If you were to read The
Spanish Frontier, you could come to the conclusion
that Spain was unable to hold on to its
North American empire, even though it held
for 300 years - 50 years longer than the
British and 100 years longer than the
French," Weber says.

Weber conducts much of his research at
IU's DeGolyer Library. "The DeGolyer is
Pueblo, an archaeological site near SMU-
Taos at Fort Burgwin, New Mexico.

Weber is too humble to claim even
changing people's minds, although he
does acknowledge changing "half a dozen"
lives through the fellowship program he
directs at the Clements Center, named for
former Texas Governor William P.
Clements. In 1995, Clements gave a $10
million gift to create the Center and
SMU's Ph.D. program in American history
with an emphasis on the Southwest.
Other benefactors include the Carl B. and
Florence E. King Foundation, the
Summerfield Roberts Foundation, and the
Summerville Foundation.

Weber credits his success in part to
being in the right place at the right histori-
cal time. "We've had a major shift in the
understanding and appreciation of Spanish
and Mexican heritage in Southwestern
America just in my lifetime," he says. The
change in perspective followed the U.S. pop-
ulation's shift southward from the Rust Belt
to the Sun Belt and the northward immi-
ration of Hispanics from Mexico, Cuba,
and Central America.

Weber remembers being fascinated by
the beauty, history, and exotic feel of
Albuquerque when he arrived at the
University of New Mexico to attend gradu-
ate school after growing up in upstate New
York. "In some respects, going to New
Mexico was like going abroad," he recalls.
There were Hispanics, Spanish was still
respect from the entire field."

Weber raises a stack of favora-
ble reviews of *The Spanish Frontier*,
Weber says "the reviewers have been very
generous." He's put together a humorous
talk in which he reviews his reviewers.
"Some reviewers wrote that I am pro-
Spanish; some wrote that I am anti-
Spanish. Some see me as pro-Indian, some
as anti-Indian, and they are all reading the
same book," he says.

He laughs at the memory of one reviewer
who wrote, "Weber's Hispanophilic (meaning
he favors the Spanish), but he's not very
good at being Hispanophilic because the evidence
he presents of Spanish misdeeds undermines
the general argument."

"I don't think one can be totally objec-
tive, although I do think we must try to be
as balanced as we can. If I have a passion
for anything, it's for that," he says.

Revisionism is an ongoing process in
history, just as it is in science, Weber says. He
refuses to commit "intellectual patrie-
de" against the historians who went before him,
saying only that they didn't go far enough in
their analysis. "It's not that the Angels did
't perform heroic deeds," he says. "They did.
They let people go west, and they fought
grizzlies, and so on. But that is a one-dimen-
sional view, and we must see all the dimen-
sions. There are other dimensions that the
next generation will see that will give an
even fuller picture - perhaps in some com-
pletely unforeseeable way."
By Susan White

For the past decade Professor of Art History Annemarie Weyl Carr has sought clues to the history of a Byzantine icon that seems as mysterious as the Holy Grail. Known today as the Kykkotissa, the great miracle-working icon of the Mother of God is named after the 11th-century Monastery of Kykkos, located on the highest mountain in Cyprus. Powerful on the island already when Cyprus was a Crusader kingdom (1191-1489), the Kykkotissa attained international fame during the height of the Ottoman reign (1570-1878).

Today the Kykkotissa remains deeply engaged in the republic’s life. The icon has been veiled from view for centuries, but its persona can be traced through the hundreds of replicas that survive in churches and icon collections throughout the Christian world. Its history, Carr says, exposes the shifting nature of icons over time, and the interplay of Orthodox tradition and Western European intervention in shaping those shifts.

Carr, who has taught at SMU since 1972 and spent her career illuminating the mysteries of the Byzantine world, was named University Distinguished Professor last fall. Her distinguished service to SMU includes two terms as chair of Meadows School of the Arts’ Division of Art History. Her classroom skills have earned her SMU’s Faculty Award for Excellence in Teaching, the Methodist Church Award for Outstanding Teacher and Scholar, and the Meadows Foundation Distinguished Teaching Fellowship. In addition, Carr’s scholarship has been recognized worldwide. She has traveled throughout the Mediterranean and the Middle East to conduct research and attend international conferences to present the results of her research on Byzantine art.

The empire called Byzantium – a term created in late 18th-century Germany – was the medieval, Christian component of the Roman empire. It lasted from the installation of the Roman government in Constantinople (now Istanbul) in 320 C.E. until the city’s fall to the Ottomans in 1453. Byzantium’s own citizens called themselves Romans. To Western Europeans, however, they seemed exotic, "dominated by mysticism, women, and Christianity," Carr says. Among the Byzantines’ greatest art forms was the icon, images of sacred figures or events venerated by believers as holy that served as mediators between the viewer and the image depicted.

"The Byzantines produced ravishing images engaged with the inward self," Carr says. "But because much of this art seemed alien to Western sensibilities, the icons have been perceived as mysterious and 'Eastern.' But they are not 'Eastern'; they are Byzantine.'"

For Carr, the Crusades served as an avenue into the historical process that "orientalized" Byzantium and its icons. Cyprus emerged as a place in which to observe that process as it occurred over centuries, because it stands at the meeting point of

IN PURSUIT OF THE SACRED

University Distinguished Professor
Annemarie Weyl Carr says the great Spanish painter El Greco began his career as an icon painter.

Saint Francis Kneeling in Meditation by El Greco 30 " x 25" Oil on canvas Meadows Museum, SMU
that has become defined by European history as opposites: as “East” and “West,” she says. The island, desired by every power seeking naval domination of the eastern Mediterranean since the days of ancient Egypt, has experienced an endless succession of invaders—from the Crusaders in the 12th century to the Ottomans in the 16th century. It was reclaimed by Britain in 1878, and launched as a bicomunalristian/Muslim republic in 1960.

“Cyprus remains one of the most stimulating places I’ve been because it has very wonderful contemporary issues that make story an extremely visible part of life here,” Carr says. Today Cyprus is a country divided between Greek-speaking Christians and Turkish-speaking Muslims. “How the different cultures live and resolve their conflicts of history and ethics makes life extremely vibrant in Cyprus, because story is a way of defining who one is.” To Carr, Cyprus seemed an ideal site to study the life of a great icon as it negotiated its place in the interplay of Crusader and Byzantine, Catholic and Orthodox.

Carr has visited churches on Cyprus, noting icons that repeat or reflect the Kykkotissa. They show the Mother of God sitting her cheek in the curls of a Christ child who twists in her arms, his little bare feet kicking from a tunic thin enough to reveal his belly button. “It’s the way all children behave,” Carr says. Here’s none of this little king sitting her arm like a puppet. That’s one of the really striking aspects of it.” Icon painters today continue to paint images of the Kykkotissa; some of the ones that repeat the Kykkotissa have become miracle-workers in their own right.

How the Kykkotissa came to Cyprus has become a matter of legend—it was sent by a Byzantine emperor in the 12th century. The earliest known that displays the Mother of God in the posture associated with the Kykkotissa was created in the 12th century, last likely in Constantinople, Carr says. Yet evidence of an icon cult at Kykkos does not emerge until the late 14th century, and is difficult to know just how the cult moved, or why it crystallized around an image of this particular type. The icon’s great fame developed in the 17th through the 19th centuries, when it was venerated throughout the Orthodox world.

“Kykkos was remarkably effective at disseminating the fame of its icon. What requires more thought is why the reception was so eager,” Carr says. “This goes deep into the condition of Orthodoxy under the Ottoman Empire, when many icons achieved great fame. But the Kykkotissa’s case also specifically has to do with its role as an icon of Cypriot identity and, eventually, national identity. This gave the Kykkotissa a vitality long into the modern era that many other icons did not enjoy. Over the centuries, the Kykkotissa has adapted to many different social, political, religious, and ethnic contexts, on Cyprus and abroad.”

Since at least the early 1700s, the Kykkotissa has been concealed behind a silver cover and heavily embroidered veils, only adding to the icon’s mysteriousness and allure. Sceptics and scholars have long challenged the monastery to uncover it, but this seems unlikely to happen, Carr says. “Cypriots have a deep feeling for the way their complex heritage has taken shape. And the veiled Kykkotissa is as much a part of their heritage as George Washington and the cherry tree is of ours. What good does it do to take it apart?”

Byzantine art historian
Annemarie Carr traces the life
of a divine image
from the 12th century.

As the audience that responded to it changed over the years, the Kykkotissa icon has assumed different meanings. “Anything that had the longevity of an image like that must have constantly renegotiated its place in people’s lives,” Carr says. What do you look for if the composition remains the same, but its meaning is constantly changing?” To that question, Carr responds by studying “styles of use.” There are periods in which the Kykkotissa icon was replicated in large panels designed for public roles in congregations. At other times the icon was replicated in small paintings for private use, registering a shift in the icon’s special appeal, she says. Many of the early replicas made of the Kykkotissa appear to be of high quality and created with expensive materials. There were periods of its life, however, particularly in the 18th century, when the majority of replicas were cheaply made. The audience that bought the cheap replicas was different from the audience responding to the costly replicas.

“I’m piecing together how the icon lived its life,” Carr says, “and in the process, I suggest ways in which art historians can learn to see the icons not as static, unchanging figures on a gold ground, but to see the life in them.”

Carr, who earned her M.A. degree and her Ph.D. from the University of Michigan, has written numerous books and articles on Byzantine art, including *Byzantine Illumination, 1150–1250: The Study of a Provincial Tradition* and *A Masterpiece of Byzantine Art Recovered: The Thirteenth-Century Murals of Lysi, Cyprus*. The books won Vasari Awards in 1987 and 1991 from the Dallas Museum of Art for outstanding art history book. Her research has been supported by numerous grants and fellowships from the National Endowment for the Humanities, The Meadows Foundation, and the Dumbarton Oaks Center for Byzantine Studies, among others.

As she continues her research, Carr hopes to learn more about icons’ relationships to the West since the fall of Byzantium. “The Crusaders took to icons like ducks to water. But at some point, icons ceased to look like ‘our’ art in Western Europe and became ‘somebody else’s art.’” But “somebody else’s art” that seems too alien to Western sensibilities also raises the same perennial issues that much of Western European art raises, Carr adds. “How does one relate to the holy? How do societies build shared imaginations? What are the threads that link us to one another?”

“Icons are powerful threads that tie people together. They were fundamental in creating a shared conception of the world. Through my research and my classes, I hope the Byzantine works become moving, and less alien.”
Compiled by Larry Smith, Director of Research and Technology Management


Ryszard Stronowski, Physics: $336,000 and $120,000, "Research in Experimental and Theoretical High-Energy Physics," and $124,000, "Optical Data Link for ATLAS Experiment at LHC," Department of Energy.


Thomas Chen, Jerry Gibson, and George Christman, Electrical Engineering: $176,000, "vBNS Connectivity for Southern Methodology of University," National Science Foundation.

Jerry Gibson, Electrical Engineering: $18,900, "Workshop: Technological Innovations and Basic Research in Communications and Information Theory Workshop, Dallas, TX," National Science Foundation.


Steven Vik, Biological Sciences: $168,304, "Structure-Function Studies of E. coli P170 ATPase," National Institutes of Health; and $45,000 and $42,000, "Metal Chelate Mediated Proteolysis of Membrane Proteins," Welch Foundation.


Anthony Marks, Anthropology: $238,927, "The Paleolithic of Portugal and the Ukraine," (anonymous sponsor).


Yıldırım Hurmuzlu, Mechanical Engineering: $100,000 and $80,000, "PC Programs that Generates Shell and Sheet Layers from X-Ray Scans," Boeing Co.-Bell Helicopter.


Thomas Chen, Jerry Gibson, and George Christman, Electrical Engineering: $176,000, "vBNS Connectivity for Southern Methodology of University," National Science Foundation.

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Yıldırım Hurmuzlu, Mechanical Engineering: $100,000 and $80,000, "PC Programs that Generates Shell and Sheet Layers from X-Ray Scans," Boeing Co.-Bell Helicopter.

William Abraham, **Theology**, was the joint winner of the national book award for the best scholarly book for 1999 given by The Institute of Christian Studies for his book *Canon and Crediterion in Christian Theology, From the Fathers to Feminism*.

Joaquin Achucarro, **Piano**, received the UNESCO Artist for Peace Award in Paris in November 1999. He was recognized for his cooperation with UNESCO concerning human rights and peace. In addition to receiving the honor, he performed for those in attendance.

Caroline Brethell, **Anthropology**, was elected vice president (1999-2000) and president (2000-2001) of the Social Science History Association, an interdisciplinary scholarly organization. She will be the first anthropologist to serve as the organization’s president.

James E. Brooks, **Geological Sciences**, received the 1999 Public Service Award from the American Association of Petroleum Geologists at its annual meeting in April in San Antonio.

Donald Butler, **Electrical Engineering**, received the 1999 Outstanding Service Award from the Dallas Chapter of the IEEE Electron Device Society.

**Nell Carwell, Learning Therapy**, received the Excellence in Education award from the Dallas branch of the International Dyslexia Association. She was recognized for her many years of work in the field of written-language disabilities, her work with the SMU Learning Therapy Program, and her work through SMU with teachers and children of Head Start to Greater Dallas.

**Richard Gunst, Statistical Science**, won the Founder’s Award from the American Statistical Association in August 1999 for exceptionally distinguished service.

**Someshwar Gupta, Electrical Engineering**, was elected a Fellow of the Institute of Electrical and Electronics Engineers for his contribution to the theory of phase-locked loops and mobile cellular communication.

**Ronald Hendel, Religious Studies**, was awarded the 1998 Frank Moore Cross Award by the American Schools of Oriental Research for his book *The Text of Genesis 1-11*.

**Debora Hunter, Art**, exhibited her work in the show “Developing Illusions, 1873-1998: Photographs from the Corcoran Collection,” presented by the Corcoran Gallery of Art in Washington, D.C.

**William K. McElvaney, Theology**, received the 1999 Texas Conference of Churches’ Fitzpatrick Award for Ecumenical Leadership for distinguished contributions to ecumenism.

**Daniel Soltkie, Economics**, was ranked by the *Journal of Applied Econometrics*, 1999, as the third most published applied economist from 1988-95.

**C.W. Smith, English**, won a $6,000 prize with the Jesse H. Jones Award for Fiction at the annual meeting of the Texas Institute of Letters in Austin for his novel *Understanding Women*.


**Jin Lovin, Theology**: $124,229, Program to Enhance Theological Tools’ Capacities to Prepare Candidates for Congregational Ministry, Lilly Endowment Inc.

**Ki Hansen, Geological Sciences**: $5,000 and $55,208, “Terrestrial Met Evolution,” and $22,000, “Tectonic Evolution of Planet Earth’s National Aeronautics and Space Administration.

**Ly Wisian-Neilson, Chemistry**: $5,000, “Poly(Phospholone) and their Spirocyclic analogs,” and $42,000, “Polyalkyl-Phosphazene polymers,” Welh Foundation; $30,000, “Synthesis and actions of Cyclic Phosphazines with Bulky Substituents: Star polymers with Phosphazene res,” American Chemical Society.


Mary Vernon says the geometric pattern builds her paintings, and color completes them by transforming the assertion of a formal plan. "I am a landscape painter, and I work out, in my paintings, the identity of landscapes, plants, and certain spaces," says Vernon, who grew up in the Pecos valley in southern New Mexico and credits the surrounding desert landscape with teaching her what to look for. An associate professor of drawing and painting in Meadows School of the Arts, Vernon has taught at SMU since 1967. Her work has appeared in exhibitions in the United States and Europe as well as in books and on compact disc covers. Vernon received her M.A. degree from the University of New Mexico, Albuquerque. To see more of her work, visit her Web sites at www.smu.edu/~art/faculty/vernon/ and www.w3art.com/MaryVernon.html.
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