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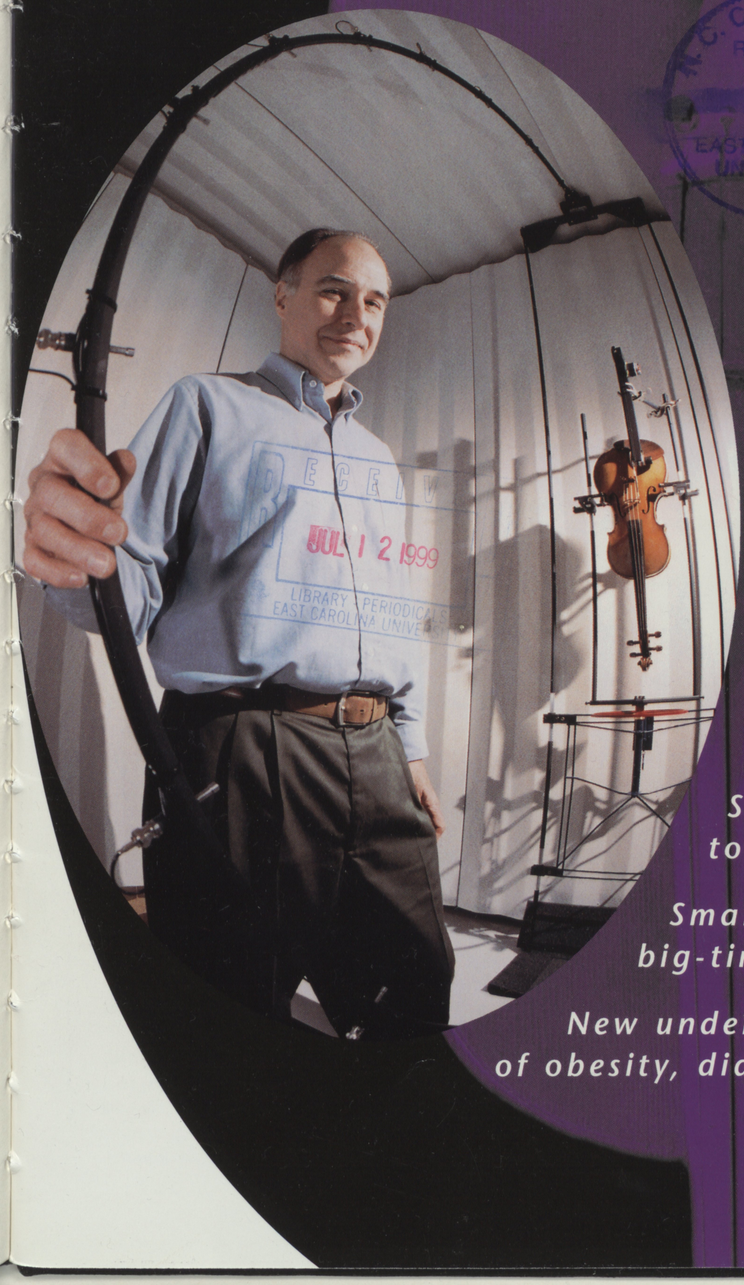

Science, art unite to build a better violin

Small-town boy/ big-time surgeon

New understanding of obesity, diabetes

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edge
research and creative activity

the next big thing

The last year has been an impressive one for East Carolina. We've received formal designation as a doctoral institution. We've dedicated the greatly expanded and fabulously renovated Joyner Library and its companion Sonic Plaza. We've completed design work for the new Science and Technology Building, which now awaits complete funding from the North Carolina General Assembly to become a reality. And we've become a member of UCAID—University Corporation for Advanced Internet Development—the association of universities working to build the next-generation Internet.

The future is equally exciting. This spring the university expects to take over the 594-acre site that formerly housed the Voice of America facilities just west of Greenville. It will immediately become home to the North Carolina Institute for Health and Safety in Agriculture, Forestry and Fisheries (see page 6).

But the site, now occupied chiefly by antenna towers, will be much more than that. As a third campus for East Carolina—the Millennium Campus, if you will—it will open up an unbelievable array of opportunities for us. Among the proposals are medical clinics, an "emeritus village" providing a learning and teaching environment for retired professors, a wetlands preservation area and a university golf course. The new campus will help us handle an expected enrollment boom in the next decade as the high school graduate pool adds an extra 50,000 students to the 16-campus University of North Carolina.

At the same time that we're planning a new bricks-and-mortar campus, we're hard at work on a Virtual University that will embrace the digital revolution to make East Carolina faculty and instructional prowess available worldwide. The challenge is to use the Internet and other information technologies to deliver ECU courses to any student at literally, any place on the globe.

The essence of these developments, both completed and planned, is simply this—East Carolina is a different place, doing business in a different way. We have always had confidence in the future, now we are helping invent it. Some of our most exciting work is reported in these pages. — *Dr. Thomas L. Feldbush, Vice Chancellor for Research and Graduate Studies*

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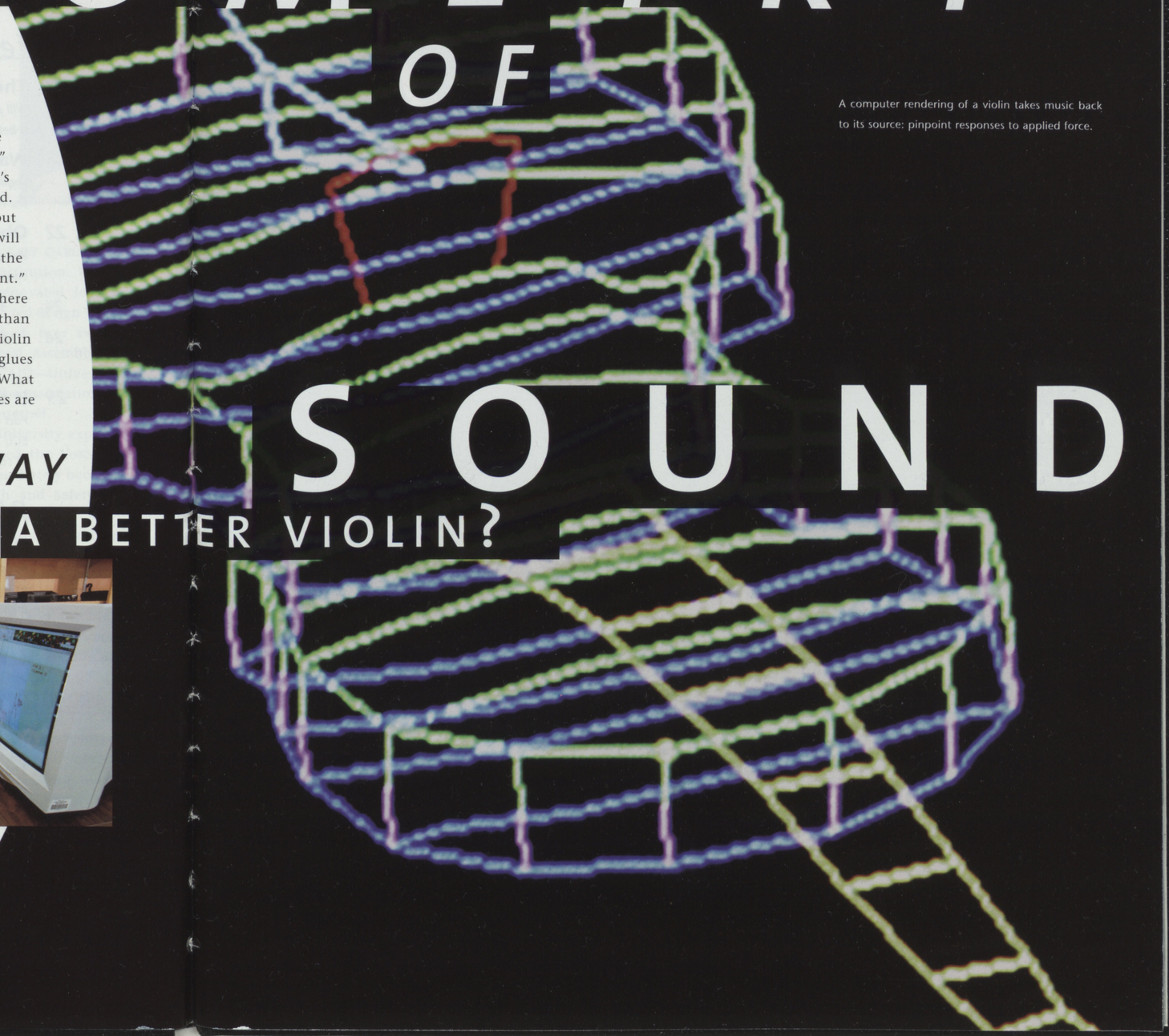
Front: Dr. George Bissinger readies equipment to measure the sound and vibration of a violin. (Photo by Cliff Hollis.)

Back: Walden Pond. (Photo courtesy of the Thoreau Society.)

Cover Design By Dana Ezzell Gay

THE GEOMETRY OF SOUND

WILL PHYSICS SHOW THE WAY TO BUILD A BETTER VIOLIN?



A computer rendering of a violin takes music back to its source: pinpoint responses to applied force.

In 1973 Dr. George Bissinger built a violin, a fateful step for this amateur musician and former nuclear physicist. "I've really spent all the 25 years since then trying to understand why, if you build it all the right way with all the right stuff, it still doesn't turn out so good—the traditional problems with making a violin," he said.

Today, Bissinger is poised to unite science and art, employing the fundamental principles of vibration to help violin makers build good violins consistently. He uses geometry—such things as shape, stiffness and density—to predict vibration, which in turn predicts sound. "There is no way, prior to the work I'm doing, anybody could predict the acoustic output of a violin from mechanical measurements," he said. The approach has attracted the interest of violin makers and the scientific community alike. One violin maker called Bissinger's technology "the tool violin makers dream of." And the National Science Foundation has awarded him and three colleagues—Drs. Robert Chin, Hamid Khan and Biwu Yang of industrial technology—a $370,000 grant to advance their research.

Bissinger, who directed ECU's particle accelerator lab from 1973 to 1992, learned to play the violin, somewhat grudgingly, as a child and took up the instrument again while finishing his doctoral work at the University of Notre Dame. He built his violin under the tutelage of musical acoustics expert Carleen Hutchins while he was on a post-doctoral appointment at Rutgers University. Years later, he heard a talk about normal mode analysis on the violin at a meeting of the Acoustical Society of America. "Being in physics, I realized that if you had the normal modes of an instrument, you literally knew everything possible there was to know about that instrument and all you had to do was figure out how all the individual modes get put together," he said.

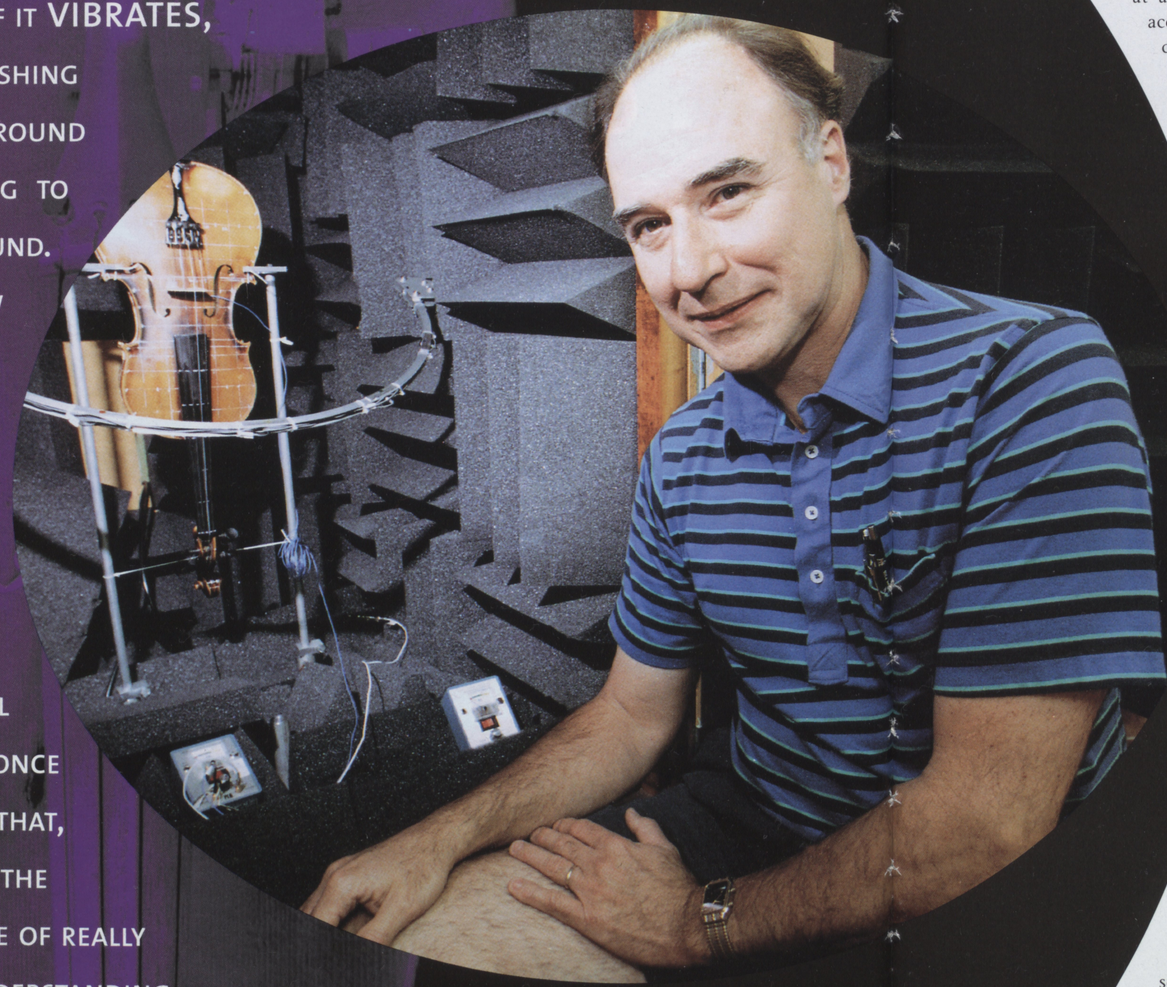
Normal modes, in this case, amount to a collection of individually unique physical responses gathered by tapping at discrete points on the body of the violin while measuring the response at a given point (or vice versa). Bissinger calls them the building blocks of vibration. "You hit it in a certain place and some modes will be excited strongly and some will not," he said. "You hit it in a different place, and different modes will be excited strongly. Any way that a violin can vibrate, no matter how you hit it, bang it, tweak it, bounce it, drop it on the ground, anything you do, you can figure out how it's going to respond to the force that you apply if you have the normal modes."

Sound flows from vibration. "If it vibrates, it's pushing the air around so it's going to radiate sound. So if you know how it vibrates, you can figure out how it radiates—even the direction in which it will radiate, and once you've got that, you have the essence of really understanding a musical instrument."

The difficulty comes in applying the concept. There are an infinite number of normal modes, but less than a thousand in the range of hearing, and every violin will be different. Wood, shape, components, even glues and worm holes can affect the normal modes. What Bissinger must do is figure out which normal modes are important to the sound quality of the violin. ›

A statistical analysis computer program will help Dr. George Bissinger sort out correlations between violin shape and sound.

SOUND FLOWS FROM VIBRATION. "IF IT VIBRATES, IT'S PUSHING THE AIR AROUND SO IT'S GOING TO RADIATE SOUND. SO IF YOU KNOW HOW IT VIBRATES, YOU CAN FIGURE OUT HOW IT RADIATES– EVEN THE DIRECTION IN WHICH IT WILL RADIATE, AND ONCE YOU'VE GOT THAT, YOU HAVE THE ESSENCE OF REALLY UNDERSTANDING A MUSICAL INSTRUMENT."



Bissinger's current anechoic, or echo-less chamber, has evolved from this earlier model.

His tools include an echo-less small room equipped with a rotatable semi-circular arc of microphones and a laser scanning system. A violin is suspended in the center of the arc, and a carefully calibrated hammer taps on the bridge of the instrument. The laser measures the resulting vibration at 270 different points on the violin, one point at a time. As mechanical energy is converted to acoustic energy, the microphones measure the direction and volume of the sound. With the cooperation of the Leo Jenkins Cancer Center at Pitt County Memorial Hospital, each violin also will undergo a computerized tomographic, or CT, scan to reveal its structure, from the shape of components to the thickness of the wood. Start to finish, measurements on a single violin take about 12 hours.

These quantitative measurements, however, cannot tell whether a violin sounds good or bad. For a qualitative assessment, Bissinger will draw on the expertise of violinists at the ECU School of Music. Then all of the information will be entered into an advanced statistical analysis computer program that will help sort out the correlations.

Before he can reach definitive conclusions, Bissinger needs to obtain measurements on hundreds of violins, from the worst sounding to the best. So far, a dozen violin makers have promised to provide instruments for him. He also hopes to measure some classic violins, even if it means transporting his equipment to such places as the Smithsonian and Library of Congress or to Europe to test museum instruments.

The overall sound of the violin relates to two independent factors, how effectively the vibrating string energy is transferred to the normal modes of the body and how well each normal mode of the body radiates this energy in the form of sound. "As you're bowing a string, you've got all these string harmonics and they're moving back and forth frequency-wise across normal modes of the body of the violin," Bissinger said. "The loudest sounds come when they cross the normal modes that radiate well. One of the things that makes the violin so appealing is that it changes so much mode to mode."

This relationship also means that a computer will be able to simulate the sound of the violin based on the measurements Bissinger has taken. "It's not that it's going to make real good violin sound," he said. "The important thing will be the trend. If you make a modification and the sound goes from a to b, you listen before and after and decide if you want to go in the other direction. With the computer, you can add just as well as subtract. In the real world, unfortunately, once you've shaved the wood off, it's difficult to get it back on, so things don't reverse so well."

The prospect excites Joseph Curtin, a renowned violin maker in Ann Arbor, Mich., who wrote a letter in support of Bissinger's NSF grant. "Here is a way of both understanding what existing violins actually do when they are played and predicting how carefully specified changes in material and design might affect the performance of a new instrument," Curtin wrote. "This is a tool violin makers dream of, and if it becomes a reality, I will be first in line to use it! It should greatly reduce the time needed to develop new instruments and contribute enormously to our understanding of old ones."

This will be a considerable change from the centuries-old approach to making and improving violins. "It's a really tough job because it's empirical," Bissinger explained. "You have to work with someone who knows how to do it. They have to do it and show you, and you have to hear it and feel it yourself. Typically, by the time the really good ones get really good, they die, and then somebody's got to learn from scratch again. That's part of the reason why we're no better now than were Antonio Stradavari and all the really great violin makers who are gone."

Bissinger is working closely with the violin makers to assure that his work will translate into useful knowledge. Peter Zaret, a violin maker from Norfolk, Va., has patented a modification for the bass bar and will supply violins before and after he has modified them so Bissinger can measure the resulting changes.

Zaret is confident of the outcome. "It's scientific confirmation of what I already know," he said. "I feel it's the best-sounding violin made."

Of course, determining the best shape for a violin is quite different from making music by applying bow to strings. As Bissinger figures it, this will be a perfect contribution to music for "nerdy people who would love to be able to play a musical instrument really well but can't."

A finger on the pulse of farmers' stress

Agricultural and medical professionals at ECU and three other universities are cooperating to help farm families cope with stresses related to depressed pork prices, the states' tobacco settlement and recent tobacco allotment cutbacks.

"During the farm crisis of the 1980s, we saw an increase in the number of suicides, incidents of family violence and highway accidents, especially in the Midwest, where the crisis hit particularly hard," said Dr. Byron Burlingham, chair of the N.C. Agromedicine Program steering committee and professor of microbiology and immunology at the ECU School of Medicine. "We're in nervous anticipation that tobacco and hog farmers may be in for the same stress responses."

The four universities are organizing a cooperative program to track stress indicators and mobilize intervention programs to head off widespread problems. Three of the universities—ECU, N.C. State University and N.C. A&T State University—already are partners in the N.C. Agromedicine Program. The fourth, the University of Kentucky, serves the country's No. 2 tobacco-producing state. North Carolina is the leading tobacco-producing state and the second major hog-producing state.

The occupational stress project is one of the latest projects of the Agromedicine Program, which was established in 1989 as a cooperative venture by ECU and NCSU. N.C. A&T signed on as a full partner in October 1998. The program may soon evolve into the N.C. Institute for Health and Safety in Agriculture, Forestry and Fisheries. The UNC General Administration is expected to approve the establishment of the institute in 1999.

Under the universities' agreement, ECU will take the administrative lead for the institute. If negotiations with the U.S. Department of Education are successful, the core institute will be housed at the former Voice of America site just west of Greenville. The 28,000-square-foot building sits on nearly 600 acres near the ECU School of Medicine. Burlingham said the building could be renovated to house the institute's administrative offices, research facilities and clinics.

PHOTO BY GEORGE THREDWITTS

Dr. Byron Burlingham leads a tour of the Voice of America site, future home of the N.C. Institute for Health and Safety in Agriculture, Forestry and Fisheries.

"Memory is a constructed, dynamic process," says Dr. Robert Nida, a specialist in children's ability to recall events.

When a child testifies

Since 1992, Central Prison's death row has been home for a Greenville man convicted of rape and murder. The key evidence linking him to the crime was the testimony of a child who was 3 1/2 years old at the time of the killing. The man's attorneys are seeking a retrial.

For Dr. Robert Nida, associate professor in the Department of Child Development and Family Relations, this case and others involving children's testimony raise a red flag. "We just don't know how accurate children's long-term memory is," he said. "We need more information on the accuracy of memory, the individual differences involved in the ability to recall and issues related to susceptibility to suggestion. It's a very tricky issue."

Nida has been studying the ability of children to give accurate court testimony for more than 10 years, first during postdoctoral studies at the University of North Carolina at Chapel Hill and now with further research at ECU. His research has focused on memory and suggestibility.

At Chapel Hill, Nida assisted in a series of studies looking into children's memory of events they personally experienced. Using the pediatric physical examination as a point of reference, the researchers interviewed children ages 3 to 7 immediately after the exam and at intervals of up to 12 weeks to see how well they could remember details of the exam and whether they could correctly deny misleading questions.

The researchers found that even the youngest children could remember the bulk of their physical exams, but they forgot more over time and were more susceptible to suggestion than were older children. The older children also were able to recall more specifics in response to open-ended questions. The children came mostly from middle- to upper-class white families.

Since coming to ECU, Nida has tried to replicate those studies with African-American children from low-income households. Although he found similarities in the ability to recall experiences, children in this study were more susceptible to suggestion. More research will be needed to explain the differences in suggestibility, he said.

Meanwhile, he said, other research has shown that interviewer bias can distort the reports of young children prone to susceptibility. Intervening events also may have a profound effect. "There's a lot of work that shows intervening experiences become integrated into memory," he said. "Memory is a constructed, dynamic process."

Tracking the first North Carolinians

The trail is cold, but Dr. I. Randolph Daniel Jr., assistant professor of anthropology, hopes ancient stone tools will point him toward sites inhabited by the first North Carolinians.

"People often think of history in North Carolina as beginning with the Lost Colony," he said, "but people lived here 10 millennia before Virginia Dare was born. So much more happened before European settlement that's equally interesting and that has a lot to say about life in North Carolina."

Anthropologists call those earliest settlers Paleoindians, for the Paleolithic era in which they first ventured onto the North American continent. Eventually, Daniel wants to decipher how North Carolina's Paleoindians lived. First, he's trying to find where they settled.

Dr. Randolph Daniel notes the size, shape and composition of tools that Paleoindians left behind in North Carolina.

Daniel has been combing public and private collections to create a comprehensive record of fluted points—stones flaked into an elongated point with a groove across the base—that have been found here. He photographs each point that appears to date to the right period (10,000 to 12,000 years ago), logs details about its shape and composition, and plots where it was found.

Stone type gives an important clue to mobility. "Hunters and gatherers have to move a lot according to where resources are available," Daniel said, "but stone for hunting may not be available where the deer are. We have evidence they planned for these contingencies." Whenever they found a good source of stone, the Paleoindians apparently packed tool kits, pieces of stone suitable for shaping into spear points and other tools, that they carried with them whenever they moved on. Rhyolite from North Carolina's Morrow Mountain, for example, has been found in South Carolina.

Already, Daniel is beginning to draw conclusions about dispersal patterns. For example, based on the large number of points found in the Piedmont, he theorizes that the high quality of stone in the region may have determined the location of the first settlements. (In a new book, Daniel argues that Uwharrie Mountain stone outcrops were the main factor in the settlement of a previously discovered site. See page 38.) Distribution patterns also will help Daniel narrow his search for an undisturbed settlement site. If he finds it, he said, he expects it will be at the fall line of a major river, buried under several feet of deposits.

In the meantime, the current study will fill a gap in information about Paleoindian distribution in the southeastern United States. Similar studies have been completed in Virginia, South Carolina and Georgia.

Nursing solutions

Lying in one position without movement for long periods can cause pressure ulcers commonly known as bed sores. A study led by nursing professor Dr. Marie E. Pokorny is testing whether a strict regimen of care will prevent ulcer development in susceptible cardiac surgery patients. The nursing staff at Pitt County Memorial Hospital is collaborating on the project.

The effort began in 1996 at the request of critical-care nurses in the cardiac surgery units of the hospital. According to national studies, pressure ulcers occur in about 15 percent of intensive-care patients. Pokorny's first task was to analyze which patients were at risk of developing ulcers. "With bed sores, you think of people who are immobilized, such as elderly patients in nursing homes or people who are paralyzed," she said. Among cardiac surgery patients who developed ulcers, she found a range of ailments that compromised circulation. Blood flow nourishes the skin and keeps it healthy. "Most were over 65," she said. "They had circulatory problems, over 50 percent had diabetes, and a lot had lung problems." Because their surgeries required them to lie motionless for long periods, their risks increased.

The next step involves testing whether stringent use of a well-defined regimen of care will prevent the development of ulcers. Nurses in the cardiac surgery unit perform a detailed assessment of a new patient's skin condition and recheck the skin twice a day, carefully documenting their findings each time. At any sign of a problem, they immediately begin outlined interventions, ranging from shifting the patients' weight to putting them on specialty beds. Again, the steps are carefully documented.

After she has collected data on 100 patients, Pokorny will evaluate the results. If the procedures appear to make a difference, she said, she will try to get them instituted in other high-risk settings, such as nursing homes.

Dr. Marie Pokorny, center, and nurse Angela Merritt examine Donald Wayne Ross for signs of potential skin problems.

Topsoil gone with the wind, rain

Challenging conventional wisdom, an ECU study has shown that significant amounts of topsoil are being eroded every year from the flat farm fields of eastern North Carolina.

Dr. Paul A. Gares, assistant professor of geography, said wind alone carries off several tons of soil per acre. Rainfall washes tons more into ponds, streams and field margins.

Erosion generally has not been considered a major threat in the coastal plain, in part because of the flat topography. The sandy soil also was thought to allow water to pass through the soil layers instead of running off. ECU faculty questioned those assumptions in the face of shallow, apparently truncated layers of soil and accumulated sediment in eastern rivers.

Working with ECU colleagues, Gares obtained a $142,000 grant from the U.S. Department of Agriculture to study erosion on coastal plain agricultural lands. Gares has continued the project, now in the fourth and final year. He presented his initial findings to the 1998 International Aeolian Conference in England.

Four tropical storms in the first year of the project left Gares awash in data on water erosion. "The crucial part is initiation of runoff," he said. "Most sediment is carried off then, before the ground is saturated." Most wind erosion occurs in February and March, generally dry, windy months when fields lie bare.

Whether it is removed by water or wind, much of the eroded soil appears to remain on site, but not all. On a windy day "coarser sand particles roll around close to ground and settle nearby, often forming little sand dunes at the edges of fields," Gares said. "The rest is dust and flies higher. There's increasing evidence that the distribution of dust is worldwide." Dust settling on the East Coast of the United States has been tracked back to Africa, he said, and North Carolina top soil may be settling in England.

At the top of their math class

Three ECU mathematicians are building an international reputation for work in the highly specialized field of operator algebra. Drs. John P. Daughtry, Elias G. Katsoulis and Timothy D. Hudson work to discover results that other mathematicians and quantum physicists may one day use.

"In their specialty, they are a first-class group," said David R. Larson, professor of mathematics at Texas A&M University and associate editor of the proceedings of the American Mathematical Society. "With three in the same area, it's one of the strongest groups in this field in the country."

Generally, their work involves determining properties for objects that defy intuition. More specifically, it means investigating problems in Hilbert's space theory, which proposes that space has an infinite number of dimensions. The field is so arcane that it can be difficult even for other mathematicians to understand. For lay people, it is harder still. Pressed to simplify, Katsoulis finally says, "It's like calculus, only more sophisticated."

Because of their stature in the field, mathematicians from other universities—including Texas A&M, the University of Lancaster in England and University of Waterloo in Canada—frequently visit the ECU campus. Every third year, Daughtry, Katsoulis and Hudson host the N.C. Conference on Operator Theory, which draws researchers from throughout the southeastern United States. Katsoulis and Hudson also organized a special session of the 1996 national meeting of the American Mathematics Society, one of only 12 special sessions held. Furthermore, Katsoulis was one of a half-dozen plenary speakers at a 1998 international conference sponsored by the North Atlantic Treaty Organization.

Each of the ECU mathematicians tackles a slightly different aspect of operator theory. For Texas A&M's Larson, those differences constitute part of their strength. "This is a creative group that works well together, as witnessed by their joint papers," he said. "They also have the reputation of working well with researchers at other universities."

An office for clinical trials

The School of Medicine opened a clinical trials office in 1998 to support researchers working with pharmaceutical companies, the federal government and other organizations to test new drugs.

"We could see we were doing an increasing number of trials, and it was apparent that clinical trials would be an increasing part of medicine," said Sam N. Pennington, the School of Medicine's associate dean for research and graduate studies. "Our vision was to create a support facility that aids investigators doing trials or those who want to do trials."

In the 1997–98 fiscal year, ECU investigators conducted 33 clinical trials worth $2.78 million.

Clinical trials are complex, from the initial contract with the trial sponsor through the process of enrolling patients, administering the drug(s) and tracking the resulting data. Usually, a team of three or four people will assist a physician-investigator on a project. Pennington said the clinical trials office will enable investigators to get their projects off the ground faster by recruiting and training staff or supplying temporary assistance. During lulls in some projects, staff can be shifted to work on others, which will help maintain the integrity of the team. "A team is fairly complex," Pennington said. "Once you have one in place, you don't want to let go."

Dr. W. James Metzger, head of the school's allergy and immunology section, is the director of the clinical trials office.

"You have to keep believing in your own stuff," Dr. Mark Taggart advises students in music composition.

A parable for the '90s

Dr. Mark Taggart, composer and associate professor of music, readily acknowledges that his music is not intended as "ear candy." After all, art claims a higher calling than easy listening. "Art gives you insight you wouldn't get elsewhere," he said.

Parable, a 1997 composition, provides a case in point. The 40-minute opera commemorates a college classmate who died of AIDS. "At the time he died, the 1994 political campaign was under way and with it, there was a hate campaign directed at gays and liberals," Taggart said. "A lot of them were quoting scripture, to my mind, to suit their own purposes. It came to me that what they were saying was almost word for word what Job's tormentors said of him."

So Taggart's opera casts Job as a gay man dying of AIDS and Job's Old Testament critics as the likes of Rush Limbaugh and U.S. Sen. Jesse Helms. For the loving, encouraging voice of God, he used the poem "To One About to Die," which Walt Whitman wrote for a Civil War soldier.

The piece was premiered with piano accompaniment at ECU in February 1997. Taggart completed the orchestral score in the fall of 1998 and hopes to find more audiences. "This needs to be heard in this region and in this culture," he said. "It lets them know that words have an effect, and it may not be the effect you wanted."

Taggart's work defies neat categories. It includes a setting of the Shaker hymn *The Humble Heart* for symphonic band; a tone poem for band inspired by the legend of John Henry; *Circination*, for solo organ; and *Lament and Credo*, written for a 12-piece saxophone orchestra.

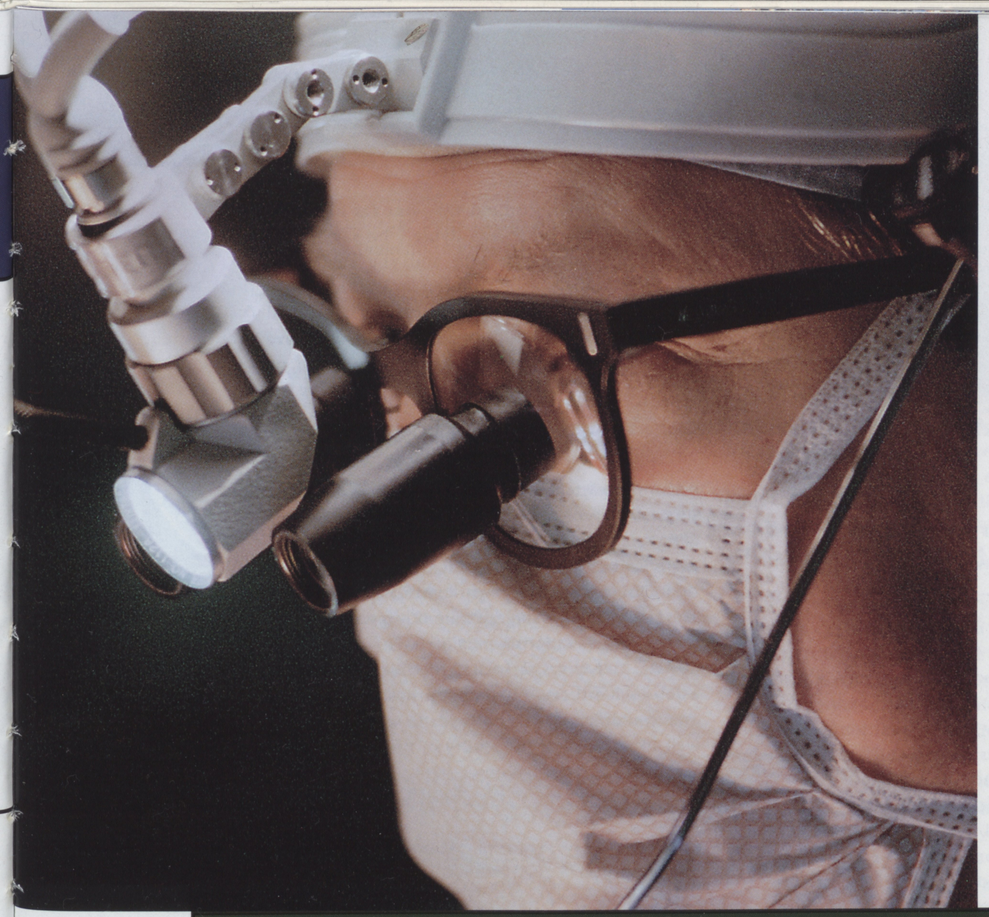
The sax orchestra has proved to be a favorite vehicle for Taggart, perhaps because he plays the saxophone himself. He has completed five movements of an eight-movement symphony for sax orchestra called *only rhythm and....* The pieces have premiered individually, and orchestras in such places as Appleton, Wis., and Hattiesburg, Miss., have committed to playing the first four movements as a single work. Taggart also will fly to Europe in the summer of 1999 to conduct the South German Saxophone Orchestra in its performance of the four movements.

Taggart already has had an opportunity to hear the German band perform the cycle he named *Vigor*. "They are a very good, very serious group," he said. "But this one movement is supposed to be comical. It has allusions to Mickey Mouse and other cartoon characters, and they were so dedicated to performing the music accurately that their seriousness added some unintended comedy."

Taggart laments the difficulty in finding venues for modern composition but does not allow it to affect his work. "I've stopped writing for other people," he said. "I say to students, you're never going to become popular like Madonna. You have to keep believing in your own stuff."

RANDOLPH CHITWOOD NEVER FORGETS HIS ROOTS AS HE BUILDS AN INTERNATIONAL REPUTATION AS A CARDIOVASCULAR SURGEON

ONE SMOOTH OPERATOR



Dr. Randolph Chitwood adopts—and adapts—new technologies for the operating room.

IN HIS YOUTH, RANNY CHITWOOD CAUSED HIS PARENTS FEW HEADACHES, EXCEPT WHEN IT CAME TO HOMEWORK. HE PREFERRED HOBBIES—PHOTOGRAPHY AND HAM RADIO—TO STUDIES. "PEOPLE PROBABLY DIDN'T THINK I'D AMOUNT TO MUCH," HE SAYS, FLASHING A QUICK GRIN.

By most standards, though, Dr. Randolph W. Chitwood Jr. has turned out pretty well. At 53, he chairs the Department of Surgery of the ECU School of Medicine and Pitt County Memorial Hospital, where he built the cardiovascular surgery program from scratch. He also is an international pioneer in both minimally invasive heart surgery and the use of robotics in heart surgery, often flying to Europe or Japan as well as around the United States to teach his surgical techniques.

With so many duties, perhaps it is no wonder that Chitwood fidgets when forced to sit and talk about himself. He crosses his legs, flips his tie, recrosses the legs, checks his watch, flips the tie again. Later, Chitwood's patients will describe an easygoing charmer who answers questions without the least sign of hurry. At this moment, however, he is impatient, eager to move on to the patients and papers that interest him more than the retelling of his life's story. "How long is this going to take?" he asks. ›

• • •

"He will drop everything in a New York minute if his family needs him," Tamara Chitwood says of her husband, Ranny.

*"When my friends meet him, the first thing they say is, **'He's intense.'** He may be a little intimidating when you first meet him."*

—ANNE CHITWOOD ON HER FATHER

Intense may be the word most often used to describe Chitwood. The trait served him well when, two years out of Hampden-Sydney College, he decided to follow family tradition and go into medicine. He quit his job as a DuPont chemist and spent a year taking additional courses required by the University of Virginia medical school. He graduated from medical school in three years and entered Duke's rigorous 10-year residency program for heart surgeons.

His arrival at Duke, he says, gave him his first taste of big-time competition. He recalls looking around in the first meeting of all new residents. "I leaned over to ol' Erle Austin, who used to be my associate here, and I said, 'Where'd you go to school?' and he said Dartmouth and Harvard. Next guy, Berkeley and Harvard. Third guy, Harvard. The guy behind me said West Virginia. I said, 'We're going to be friends.'"

He had almost a year to go in his residency when he came to the attention of Dr. Walter J. Pories, then-chair of ECU's surgery department. Pories was looking for someone to start a heart surgery program in Greenville. Chitwood's mentor at Duke, Dr. David Sabiston Jr., spoke highly of his protégé, and Pories invited the young doctor for an interview.

Chitwood was impressed by the details Pories had amassed to support plans for a heart program and even more impressed by what Pories offered—a decent salary, a full professorship and chief of cardiac surgery, all straight out of training. "I was driving an old VW—one car had died, the other was dying," he says. "So I called my wife and she said, 'Oh, that's good. You can look at that job.'"

For the next nine months, Chitwood worked in Durham weekdays and drove to Greenville on weekends, hiring staff, buying equipment and laying the foundation for a research program. On July 10, 1984, within a week of arriving in Greenville full time, Chitwood performed eastern North Carolina's first open-heart surgery, a coronary bypass operation. He operated 300 more times that first year, spending the night in the hospital to watch his patient after every operation. Only then did he begin to hire other surgeons. The cardiovascular surgery team now performs more than 1,200 operations annually.

After five years, a frustrated Chitwood left for a job in Kentucky. "I wanted a heart center here and couldn't get it," he says. "I see now it was well in advance of the ability of the institution to respond, but when you're going at this speed, you just expect the next level, and you can't always convince people." Kentucky's bluegrass turned out to be greener from a distance than close up. Two years later, Chitwood was back in Greenville, negotiating for—and getting—a multidisciplinary heart center that pulls diagnostics, therapeutics, surgery and rehabilitation under one roof.

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*"He was a very strong-willed child. **He's still strong-willed.** I think he likes to excel and wants to be at the top of his field."*

—RUTH ANN CHITWOOD TALKING ABOUT HER SON

One goal accomplished, Chitwood needed another. "I had been piddling for a long time with the idea of how to operate on a totally closed chest," he says. Then French surgeon Alain Carpentier announced that he had performed the first endoscopic mitral valve operation. (The mitral valve sits between the upper and lower chambers on the left side of the heart.) Instead of cutting the chest open and spreading the ribs, Carpentier had worked through a relatively small hole in the ribs. A tiny camera inserted into the incision projected images on a video screen to guide the surgeon's hands. For the patient, the result was less pain and faster recovery. Chitwood met with Carpentier and set out to develop his own endoscopic mitral valve operation.

Step one was to find a way to stop the beating heart long enough for the surgery but without the necessity of putting the patient on a heart-lung machine. A U.S. surgical equipment company was testing a balloon device that stopped the heart by shutting off blood flow through the aorta. Chitwood asked for one of the tools but was turned down. Only the Stanford University medical center could use the device, the company said.

"So I sat in the cafeteria and sketched out a design for a clamp that would occlude the aorta and that would take their $5,000 balloon out of action," he says. Chitwood's $1,000 clamp, unlike the balloon, is reusable.

Chitwood performed the first minimally invasive mitral valve operation in North America on May 24, 1996. He then designed more instruments, giving them long handles to make it easier to work through a small incision. In 1998 he added a new twist. For his first endoscopic surgery, a human assistant held the camera, moving it at Chitwood's direction. Today, a voice-activated robot controls the camera.

"The vision is to develop a totally endoscopic operation so the next generation of surgeons with 3D cameras and robotic devices can do this with facility," he says.

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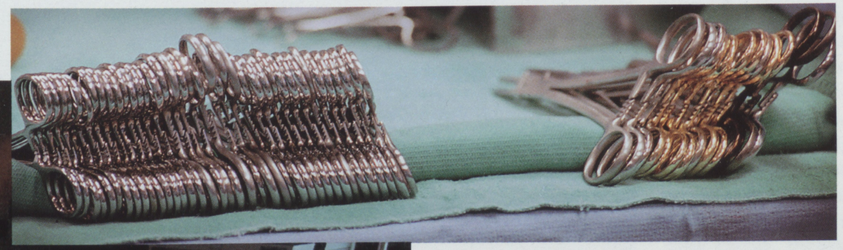
*"He's not a workaholic. **He just loves what he does.** It's hard. It's demanding, but it's not labor. And he's great at it. I've mentioned his name here, and people recognize who he is. He has an international reputation."*

—ROBERT M. JOHNSON, LECTURER IN ENTREPRENEURSHIP AT THE LONDON BUSINESS SCHOOL AND CHITWOOD'S FRIEND SINCE CHILDHOOD

Hard work and medicine were bred into Chitwood. His sister is a doctor. So were his father, grandfather and uncle. His mother and grandmother were nurses. Saturdays usually took him to the ›



Chitwood and his staff prepare a patient for surgery, one of 1,200 heart operations that will be performed this year at Pitt County Memorial Hospital. Above right, surgical clamps are sterilized and ready for use.

Chitwood Clinic in his hometown of Wytheville, Va., where he folded gauze and blew up gloves to test for holes. Often, he accompanied his father on house calls, opening and closing farm gates along the way.

Chitwood also had watched his father work late into the night and on weekends. He knew long hours came with the territory when he entered medicine. For eight of the 10 years of his residency, he spent every other night on call at the hospital. "At that time, I considered that if you weren't on call a lot, you were missing stuff," he says.

Harrizene Keyes, his administrative assistant, suggests that part of the drive comes from the undivided attention he demands for his patients. A few years back, the surgeon himself underwent quadruple coronary bypass surgery. "Coming out of the ICU, he was still worried about the operation of the office," Keyes says. "When he went home, he was working there. He even came by the office to see what needed to be done and check on patients."

Chitwood confirms that coronary disease, which he attributes to genetics, has not slowed him down. "I'm working twice as hard as I was before surgery," he says. "What gives you coronary disease, as far as stress is concerned, is not operating on the human heart. It's what most managers deal with—personnel, deadlines, people calling for manuscript review, overcommitment, the anger associated with that, the inability to get things done. But the stress of operating on a high-risk patient carries you like the guy coming down the biggest ski slope. You're trained to do it. It carries you to technical heights. My heart rate in the operating room is lower than it is right now."

The greater cost of his schedule has been time with family. Regrets come with the territory, he says. He wishes that he had called his parents more often, that he had spent more time with his wife, Tamara, and children, Anne, a University of Virginia graduate working in the Washington, D.C., office of U.S. Senator Jesse Helms, and Randolph III, a geology major at the University of Montana. The decision that family could not always come first was made when he entered medical school, he says.

His family is more generous. They say he made time for the important events, trick-or-treating on Halloween, Honor Society induction, the occasional college football weekend. "He will drop everything in a New York minute if his family needs him," Tammy Chitwood says. "In '95, I was diagnosed with Hodgkin's disease. He was right there with me. When my father became ill, he dropped everything and was there with him when he drew his last breath."

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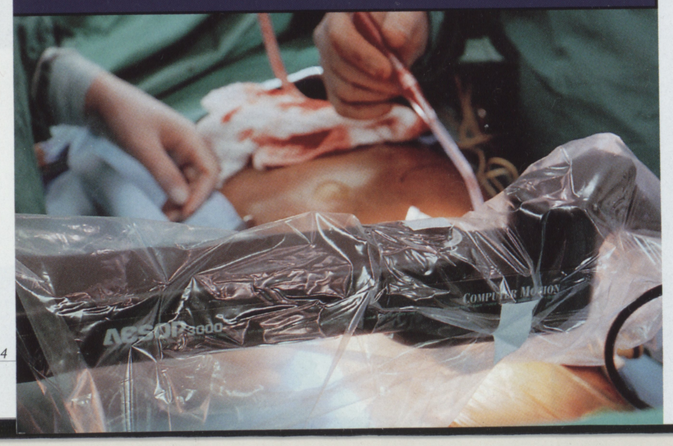
*"When I met him, **I wanted him to do it.** He didn't make us any great promises, but if somebody's going to cut your chest open, it's important that you have a good gut feeling about that person. It's not like somebody doing your taxes or something that can be fixed."*

—TERRY RATCHFORD, PATIENT

"My heart rate is lower in the operating room than it is right now," Chitwood says in an interview.



Terry Ratchford, an insurance agent from Gastonia, got bad news from his cardiologist in the fall of 1997. He needed surgery to correct a defective mitral valve. After conferring with surgeons in Charlotte, Ratchford had resigned himself to open-heart surgery and valve replacement, but relatives and friends had heard about a doctor in Greenville who had developed a procedure that didn't require opening up the chest. At his mother's insistence, he drove across the state to meet Ranny Chitwood.

Chitwood indulges his passion for antique medical instruments and books and for all things related to fellow Virginian Thomas Jefferson.

Looking back, Ratchford calls his a storybook case. Chitwood was able to repair, rather than replace, the defective valve using minimally invasive techniques, and the surgeon made him feel comfortable throughout.

"He came in that first day and was totally professional but very warm," Ratchford says. "He has tremendous bedside manner. He was charming, very accommodating and not at all in a hurry. He makes sure you get all your questions answered. When he looks you in the eye, you trust him."

Ratchford was able to leave the hospital after only three and a half days. Back home, a check-up with his cardiologist produced a verdict of "perfect." Even before the check-up, the cardiologist had a good idea of how his patient was doing. "From the moment I met [Chitwood], he started corresponding with my cardiologist," Ratchford says. "He keeps the other guys and girls totally informed."

Good communication with referring doctors has been a key to Chitwood's strategy, coming right behind excellence in quality. "These guys are going down to Rotary Club from their office to eat the chicken and sing the song at lunch and then they run into Uncle Louie down there and he says, 'How's Aunt Sally?' It's pretty impressive for him to say, 'Oh yeah, Dr. Chitwood called me right out of the operating room. She's in the recovery room now.' It makes it look like he's on top of things. I learned that from my old man."

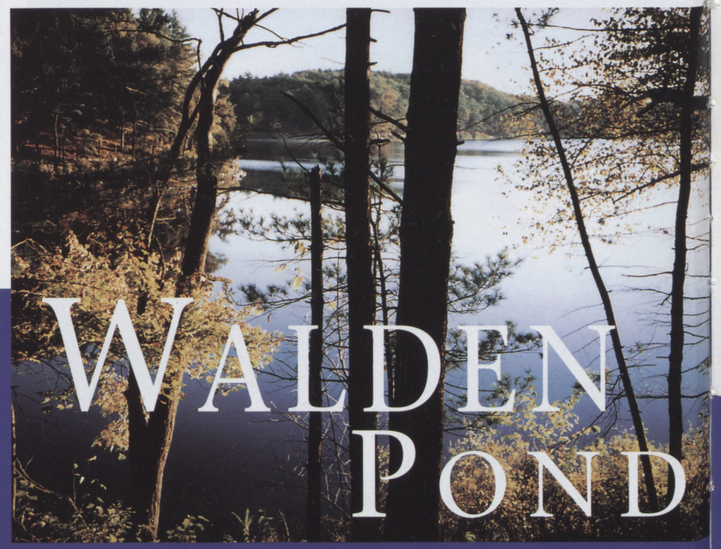
The "old man" crops up frequently in his conversation. A bust of Thomas Jefferson sits in Chitwood's hospital office. In his new home, his wife is having the parquet floor of Monticello reproduced in the suite of rooms that will house Chitwood's study, darkroom, ham radio equipment and a library for a collection of antique medical books, instruments and his grandfather's medical saddle bags. It is obvious that Chitwood admires Jefferson and the many inventors and surgeons he quotes with ease. He stops short, however, of calling them heroes. Instead, he recalls his father.

"You have to be careful with heroes," he says. "You pick out a hero and have to remember they're just people. They have problems, too. But sure, you have heroes. Your parents are heroes. Your father's a lot smarter 30 years hence. He's dead now, and you can't tell him. Some of those little things, though—you pick up on the subtleties later on, and you really wish he was around so you could ask him what he meant."

Chitwood's voice trails off. Memories of his true hero, the one he wishes he had called more often, fill the silence. Miles away, from an office in the nation's capital, another Chitwood has found a hero, too.

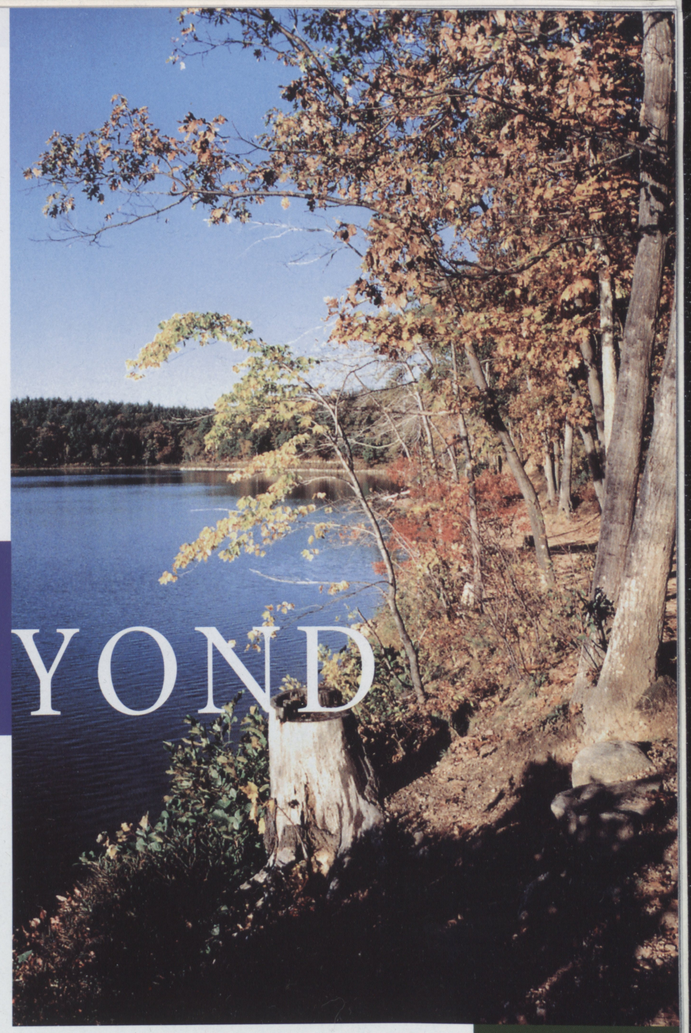
"Sometimes I think he's a little hard on himself," daughter Anne says. "I've met a lot of people. They say, 'You're Ranny Chitwood's daughter. He operated on my father' or 'He operated on my uncle. What would eastern North Carolina do without him?' I just swell with pride."

English professor ***Ronald Hoag*** *explores the many facets of the* ***Thoreau*** *legacy*



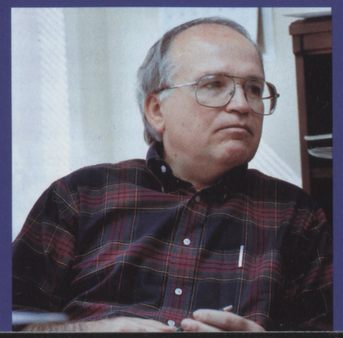
WALDEN POND *and* BEYOND

PHOTOS COURTESY OF THE THOREAU SOCIETY



Walden Pond, where Thoreau carried out his experiment in transcendental living, looks today much as it did in the 19th century.

As a youth, Dr. Ronald Wesley Hoag cast his fishing line into Walden Pond, near Concord, Mass., without any distinct idea of who had fished those waters before him. Today he is a leading scholar of the works of the pond's most famous visitor, Henry David Thoreau. Hoag serves as the treasurer of the Thoreau Society, an organization dedicated to studying Thoreau and his work, and he edits *The Concord Saunterer*, the society's annual journal. He also is an adviser to the Walden Woods Project, which seeks to preserve the land most closely associated with Thoreau, and was a contributor to *The Cambridge Companion to Henry David Thoreau*. Although Thoreau lived from 1817 to 1861, his work continues to resonate worldwide. In spring 1998, President and Mrs. Clinton joined the Thoreau Society and Walden Woods Project in dedicating the new Thoreau Institute for research and education. Recently, ***edge*** talked with Hoag, a professor of English, about Thoreau's legacy.



Dr. Ronald Hoag has made Henry David Thoreau the focus of his career. He studies Thoreau's life and works—and sometimes retraces his steps.

edge: *What accounts for Thoreau's status as an American icon?*

Hoag: There are three areas of Thoreau's life and work that are particularly important. One is as a transcendentalist. Another is as a political thinker, and the third area, which is the subject of most of the new books and articles today, has to do with Thoreau as a founder of the science of ecology.

edge: *Let's explore those one at a time, starting with transcendentalism. What was Thoreau's major contribution there?*

Hoag: Ralph Waldo Emerson, his mentor, was the principal formulator of the theory of transcendentalism as it gets translated into American culture from various other sources. Basically, transcendentalism assumes that there is a relationship between the physical and the spiritual and that a person can find spiritual significance by engaging with physical nature in a conscious, receptive way. Thoreau was a real pragmatist and put everything to the test. He read Emerson's statement of transcendentalism, published in a pamphlet called *Nature*, and wanted to see if these ideas would hold up. That's basically why he went out to Walden Pond for a couple of years—to see if, away from the distractions of the community—the transcendental approach will work. It's his experiment in transcendental living, and in the end, he pronounces it a success. He says, yes, you're never going to get to the bottom of the universe, but you'll get deeper and deeper into the meaning of it until finally, (the fact) that it's unfathomable becomes a "good" because it suggests just how much meaning is there, an infinite amount. It gives you a reason to get up the next day and go look for some more. So his contribution is that of a successful practitioner of transcendentalism.

edge: *Those of us who came of age during the '60s and '70s think of Thoreau in more political terms. What's the source of this influence?*

Hoag: One of his legacies is the rationale for civil disobedience. He went to jail briefly rather than pay his poll tax because he saw the poll tax as supporting slavery. (In the essay "On Civil Disobedience") Thoreau asks why, even in a democracy, ›

The Concord Saunterer, which Hoag edits, carries articles by established scholars and significant newcomers.

a simple majority vote should determine what is right. You could have a majority of people who happen to be in the wrong. So, he says, conscience should be the final arbiter when it comes to making moral decisions, and any man more right than his neighbors constitutes a majority of one. And, he says that we should not just wait for unjust laws to change or obey them while working to change them, but if they are truly unjust, then they are immoral and we should go ahead and break them. That plays out in the 20th century in particular with Mohandes Gandhi in India and also with Martin Luther King Jr. Thoreau is one of the foundations they both built on, and his ideas became very popular during the 1960s.

***edge**: We know Thoreau went off into the woods to do his thinking, but you've suggested that his contributions to science extend beyond that of nature lover.*

HOAG: There's been a whole spate of new scholarship on this dimension of Thoreau's work. It began in 1993 when Bradley Dean, who used to be a colleague here at ECU, edited and published *Faith in a Seed*, a book that presented a previously unpublished manuscript by Thoreau called "The Dispersion of Seeds." This book shows Thoreau was really ahead of the scientific establishment of his time. The prevailing assumption of the day was that some plants just spring up by spontaneous generation or what was called "special creation." This was the opinion even of Louis Agassiz of Harvard, the top American naturalist. Thoreau, who had been doing lots and lots of field work, concluded no, it isn't spontaneous generation. Instead, you have this whole mechanism in nature that disperses seed. It's done by wind, by animals. He uses the example of a city person who goes for an outing in the countryside and takes a walk and comes back carrying sticky burrs on his clothes, and those sticky burrs transplant seeds to wherever that person happens to get off the train at the end of the day.

Thoreau's conclusion was that nature is not a hodgepodge of isolated phenomena. It's a web, and if you touch the web at one point, you'd better be careful because it's going to have an impact somewhere else. That, of course, is the whole notion of ecology and ecosystems, words that didn't exist in his day. Yet you can take page after page of his writing, especially his later writing, and put them appropriately into an ecology textbook today. That's the reason he's now considered a principal founder of the science of ecology.

***edge**: These three areas of contribution are very different from each other. Is there a common denominator to Thoreau's work?*

HOAG: In *Walden*, he says one of the conclusions he draws from his experience is that the universe is wider than our views of it. He tries to get beyond our narrow views by consciously going beyond boundaries, in everything. If you look at the transcendental area, he is going beyond the physical to see the spiritual. If you look at the political area, he is going beyond that narrow definition of right that is inscribed into the laws and insisting on a wider, more moral definition derived from conscience and consciousness and God.

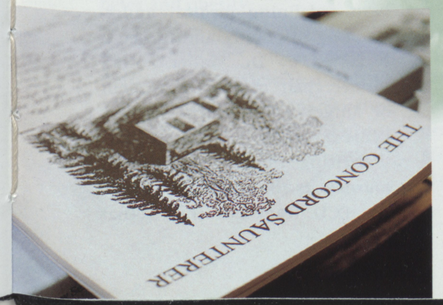
Thoreau was a big advocate of what he called "the wild." In one of his essays, he states, "In wildness is the preservation of the world," which the Sierra Club often quotes. I think for Thoreau, wildness is just another word for that idea of going beyond bounds. When he made a trip that he discusses in the first of three essays in *The Maine Woods*, he talks about leaving civilization and climbing a fence and then going into the woods. When you read it, it sounds like a simple statement of what he did. But it's that act of going OVER the fence, of going BEYOND bounds that's in his thinking, in his seeing, in his speech, in everything.

***edge**: You've made a particular study of those essays, haven't you?*

HOAG: One of the two best things I've done as a scholar is an article I wrote on *The Maine Woods* ("The Mark on the Wilderness: Thoreau's Contact with Ktaadn," published in *Texas Studies in Literature and Language*, spring 1982.) For a lot of people, it changed the thinking on some key passages. He said at the beginning of the essay "Ktaadn" that here in the wilderness, one must confront the true source of evil. At the end of his account, he's on the top of this bald mountain, Katahdin (modern spelling). It's windy and off-putting and he's obviously trembling and feeling overwhelmed. Other commentators had said well, putting two and two together, he must now think that nature is evil instead of being spiritual and something you'd want to tap into. Someone refers to this key passage as a chink in his transcendental armor.

"THOREAU WAS A BIG ADVOCATE OF WHAT HE CALLED 'THE WILD.'. . . I THINK FOR THOREAU, WILDNESS IS JUST ANOTHER WORD FOR THAT IDEA OF GOING BEYOND BOUNDS."

The article I wrote said no, you've got the language right but you're making the wrong interpretation. What Thoreau was doing here in "Ktaadn" is describing his experience of the sublime. The whole tradition of the sublime in nature involves things like the Alps or Niagara Falls or the Grand Canyon or the ocean in a storm. These are natural phenomena that make you feel bowled over, but what you're experiencing is the power of nature. Thoreau says that rather than making fear the controlling principle of the sublime experience, he sees that principle as reverence and wonder and awe. This is why Katahdin becomes his holy mountain and why he writes about it positively from then on. The evil he writes of confronting is actually mankind, including to some extent Thoreau himself, because man insists on dominating the wilderness, confining in one way or another what was meant to be wild.



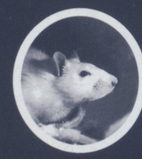
***edge**: You said this was one of your two most important works. What's the other?*

HOAG: The other I did with Brad Dean. It was a book-length examination of Thoreau's career as a lecturer. Thoreau had an active, long career as a lecturer, and it's significant because he would write his observations in his journal, then take things from various journal entries and work them into lectures. From the lectures they would become essays, and then finally some of them would become books. But no one had fully examined his career as a lecturer. We put together the fullest account that's been published.

For each lecture, we give a narrative of the event, a section that deals with advertisements and reviews, and a description of the lecture itself. In some cases, we found accounts in newspapers where you would swear the newspaper reporter had a tape recorder because he's got seemingly verbatim what the whole lecture would be. You can take that and put it up against the published essay or whatever came as a result, and you can see Thoreau's thinking at work as he embellished some things that got a good response or took out others that went over like a lead balloon. You can see him, the writer, at work. Our study was published in the *Studies in the American Renaissance* series from the University Press of Virginia divided into lectures before *Walden* and after *Walden*.

***edge**: The Concord Saunterer, which you edit, goes to all 1,800 members of the Thoreau Society and is also sold to the public. These readers include university scholars from many different fields and a majority of members and others who aren't academicians at all. How do you appeal to such a broad audience?*

HOAG: I try to get as many articles of different kinds in the journal as I can. Thoreau wore many hats, and Thoreauvians collectively wear many hats, too. There are lots of different areas of interest in him. I can't appeal to them all the time, but I can be aware that they're out there and take advantage of opportunities to present something that addresses a constituency that doesn't often get attention. I'm also not much into recent trends in critical theory that require a translator to understand. The articles we publish are sophisticated—we publish articles by some of the most established scholars as well as by significant newcomers—but if a reader comprehends English and puts in a little time and thought, there's nothing that we publish that can't be understood.



RESEARCH YIELDS STARTLING CLUES TO THE COMPLEX CONNECTIONS BETWEEN TWO DEADLY CONDITIONS

Obesity and diabetes

"Most patients are so surprised that someone will listen and agree they have a bad disease," says Dr. Walter Pories, shown here with Glenda Williams.

A Pamlico County woman sits quietly as she waits to see her doctor. At age 32, she weighs 419 pounds and suffers from diabetes, high blood pressure and a host of other ailments.

She knows her health risks—her father weighed 500 pounds and died from complications of diabetes—and she has decided to move beyond the diets and medications that have accomplished so little. Her hopes now rest in the staff of the ECU School of Medicine.

Her choice is well-founded. Over the past 15 years, a multidisciplinary research team here has been redefining medical understanding of obesity and diabetes. It is led by Dr. Walter Pories, former chair of the Department of Surgery, and biochemist Dr. Lynis Dohm.

Writing in such prestigious journals as the *Annals of Surgery*, the ECU team has shown that when morbidly obese, diabetic patients undergo a special operation to bypass much of the stomach, their diabetes lessens, often disappearing spontaneously. This finding has led the researchers to suggest that non-insulin-dependent diabetes stems from hormonal signals originating in the lower stomach or upper small intestine. They also have shown that as these surgical patients lose weight and as control of their diabetes improves, other measures of overall health improve disproportionately, and they live longer than similar patients who do not undergo surgery.

More discoveries may be on the horizon. As the scientists continue to refine their understanding of the mechanism of diabetes, they are opening new explorations into how the body burns and stores fat. And, in a new partnership with the pharmaceutical giant Eli Lilly, they are seeking out the genes responsible for both diabetes and obesity.

The team is a rarity in medical science. "What's unique here is that we have basic scientists and people who are surgeons working together," Dohm said. "It's not often you get this kind of collaboration." In addition to Pories and Dohm, the core research group includes seven lead investigators: in surgery, Drs. Paul Cunningham and Kenneth MacDonald; in the medical school's basic science division, Drs. Hisham Barakat and Madhur Sinha; and in the Human Performance Laboratory, Drs. Joe Houmard, Robert Hickner and Ronald Cortright. The collaboration has developed out of an equally unusual set of circumstances.

"In 1977, when we started (the medical school) here at ECU, we recognized that obesity was a major problem in eastern North Carolina and decided to make it a focus of our work," Pories said. Obesity is closely associated with numerous health problems, including diabetes, heart disease, high blood pressure, degenerative joint disease and some cancers.

Morbid obesity—generally defined as 100 pounds or more over a person's ideal weight—carries the most serious risks, but also has proved most difficult to treat. Once the human body has reached a set point, it vigorously defends itself against weight reduction. Cut back on calories, and metabolism slows. Succeed in losing weight, and the body puts it back on at the earliest opportunity. Since exercise revs up the metabolism, an average person may shed excess pounds through a combination of diet and exercise. This approach may be less than realistic for the morbidly obese, however. "To tell someone whose weight is 400 pounds to walk four miles a day is insane," Pories said.

He sought another approach—surgery. By reducing the size of the stomach, he also would drastically restrict the number of calories a patient could consume. Weight loss should follow.

He tried several operations described in medical literature. When none proved optimal, he began making his own revisions. After 200 surgeries, he had developed what has become known worldwide as the Greenville Gastric Bypass. This operation divides the stomach so that food can reach only a small pouch at the top. From there, it empties into a shortened section of intestine. This both limits the amount of food someone can eat and speeds its passage, reducing absorption. ›

Dr. Lynis Dohm's work with mice and exercise is key to understanding cellular factors in diabetes.

From the start, results with the bypass were remarkable. Most patients lost more than 100 pounds within two years, dropping from an average of 314 pounds to 206. Equally remarkable, most of the weight stayed off.

Pories noticed something else. When he operated on his first diabetic patient, the diabetes disappeared even before weight loss had occurred. "At first, I thought we hadn't done a good job of diagnosing the diabetes," he said. "Then I saw it happen several more times."

Perplexed, he approached the scientists who study the chemical and molecular workings of the body. Together, they began the search for explanations.

The gastric bypass patients provided a rare opportunity. About one-third were diabetic, and another third had insulin resistance, a precondition to diabetes. The scientists could study these patients when they were obese and after they lost weight and when they exhibited diabetes and when they did not. They also could compare diabetic and non-diabetic patients. A key component of the research has been tissue obtained, with the patients' permission, at the time of their bypass surgery. Small sections of liver, muscle and adipose (fat) tissue go to the labs where the scientists developed specialized techniques for preserving and growing the tissue for experiments.

These factors together amount to "a tremendous opportunity we have that almost no one else does," Dohm said.

Some of the most stunning results have come from examining the long-term consequences of surgery. For example:

- Gastric bypass patients and similarly obese patients who did not undergo surgery were followed for periods of six to 10 years. During this time, the surgery patients had a much lower chance of dying in any given year. This was attributed to a decrease in deaths from cardiovascular disease.
- Among those same surgical and nonsurgical patients, the need for medical treatment for diabetes differed significantly. The percentage of surgical patients taking oral medication for diabetes dropped while the proportion of nonsurgical patients on medication increased.
- In terms of metabolic fitness, the surgical patients are significantly better off than their weight predicts. After surgery, they become more insulin sensitive, even before they begin to lose weight. When they are put on an exercise program, they show greater improvements in fitness than do nonsurgical patients (matched for such factors as size and sex) on the same program.

THE DIABETES-OBESITY CONNECTION

The National Institutes of Health estimates that 16 million Americans have diabetes mellitus, a serious disease that may lead to such complications as blindness, kidney failure, coronary artery disease and nerve damage. It costs the United States approximately $100 billion every year, about half of that in direct medical expenses.

Although there are different forms of diabetes, in all cases it affects metabolism, the body's way of turning food into fuel. The body breaks most food down into a simple sugar called glucose, its main source of fuel. To make use of that fuel, it also needs insulin, a hormone produced by the pancreas.

The condition known as insulin-dependent diabetes occurs when the pancreas cannot make insulin. As a result, the body is deprived of fuel, and unhealthy levels of glucose build up in the blood stream. This accounts for about 5 percent of all diabetes. Most often, insulin-dependent diabetes is diagnosed in children or young adults. Treatment includes regular injections of insulin and careful regulation of the diet.

Non-insulin-dependent diabetes accounts for 90 to 95 percent of diabetes mellitus in the United States. It occurs mostly in adults of middle-age or older and in people who are overweight. In this condition, the pancreas produces insulin, but the cells are unable to make effective use of it, a condition known as insulin resistance. A majority of people who are overweight have some degree of insulin resistance, but only a portion develop diabetes. Diabetes is diagnosed when blood glucose reaches an unhealthy level. Non-insulin-dependent diabetes often may be treated with diet and exercise alone, but oral medication is sometimes needed.

Weight and diet affect diabetes in ways that are still being studied. Both body fat and fat circulating in the bloodstream appear to interfere with the ability of cells to use insulin. The pancreas compensates by producing additional insulin, but as people put on more and more weight, the pancreas may be unable to keep up with the added demand. Sometimes, the strain may be so great that the pancreas wears out, and insulin-dependent diabetes results. A proper diet reduces the amount of insulin needed by limiting the amount of glucose and fat circulating in the bloodstream. Similarly, weight loss reduces the territory the insulin must cover.

Exercise has been shown to increase the cells' ability to use insulin as much as twofold. How this occurs is under investigation. Exercise also aids weight reduction, a further benefit in controlling diabetes. ▬

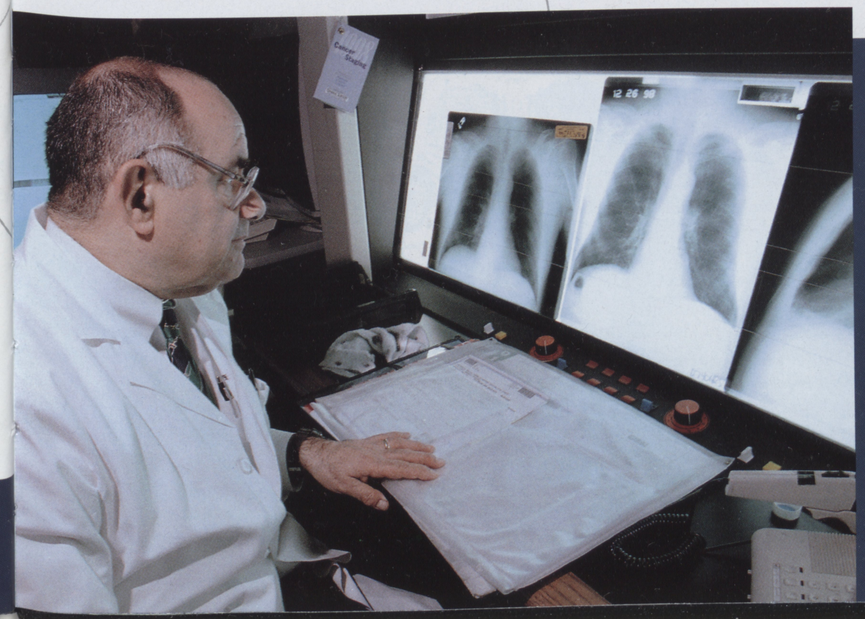
A nagging question remains—how much the improvements in the gastric bypass patients can be attributed to the surgery and how much to the dietary restrictions it imposes. (After full recovery, most patients can eat no more than half a hamburger at one time.) Early on, Pories ran a study to rule out the effect of diet. To do this, he compared patients who had gastric bypass surgery with patients who tried to lose weight through diet alone. "They weighed the same, but the difference in metabolism was enormous," Pories said. "When diabetic patients diet alone, insulin resistance lessens, but it doesn't disappear."

A current trial of a different surgical procedure for morbid obesity may offer further evidence. Gastric banding cinches the stomach to allow less food to pass through, but unlike the gastric bypass, it does not change the basic physiology of the digestive system. Food continues to pass through the entire stomach and intestine. As gastric banding patients return for one-year checkups, their progress will be compared with that of bypass patients. If bypass patients again show superior fitness, it will give diabetes researchers more reason to focus tightly on hormonal signals originating in the gut.

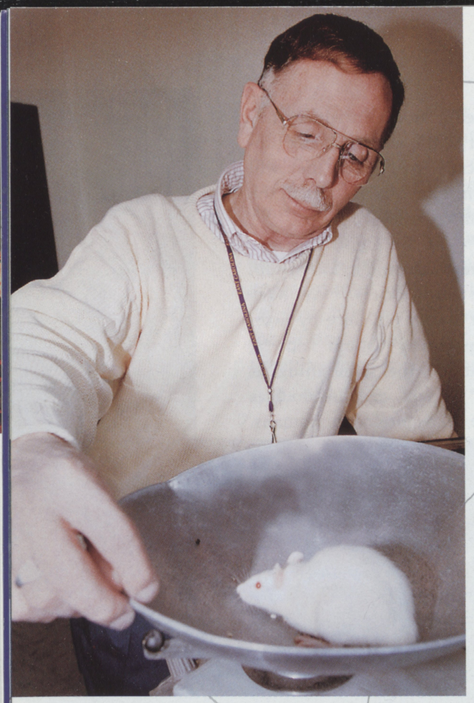
Progress also is coming on the cellular front, where advances in knowledge are measured in increments. The researchers, for example, have narrowed in on at least one factor contributing to insulin resistance, the overabundance of an enzyme that appears to block cells from absorbing glucose in response to insulin. To prove their theory, they have developed a mouse in which they can control the amount of the enzyme being produced. Next, to prove cause and effect, they will chart the changes in insulin activity when the enzyme is activated at different levels.

Similarly, they are close to identifying the regions on a gene that regulate production of substances called glucose transporters. "We have found that we can cure diabetes in mice by overexpressing glucose transporters," Dohm said. "It turns out that you can do the same thing in humans by exercising." In fact, exercise doubles the number of glucose transporters in humans. Production of glucose transporters appears to be controlled by several different "promoter" regions on the genes. The scientists have located one region on the gene that directs the thyroid hormone to produce transporters. Now they are seeking the region that is activated by exercise.

The basic and applied aspects of this work dovetail as tightly as the sides of a well-made drawer. As Dohm's lab splices genes to locate promoter regions, the team in the Human Performance Lab works with human volunteers to refine knowledge about the effects of exercise on glucose transporters. They have shown that the number of transporters increases substantially with as little as one week of regular exercise and that the effects may be maintained when the frequency of exercise is reduced. The answers to all these questions about glucose transporters may come together one day in a new treatment for diabetes. ›



Pories, shown reviewing x-rays, developed the Greenville Gastric Bypass to help obese people lose weight. Above, a genetically engineered mouse allows researchers to control production of an enzyme that blocks the absorption of glucose.



"We think there are some changes in lipid metabolism that really predispose people to become obese," says Dr. Lynis Dohm.

The team also is opening new areas of exploration. Eli Lilly has awarded ECU a five-year, $2.5 million grant for a cooperative study of the genetics of obesity and diabetes. The ECU team is providing Lilly with tissue and blood samples from patients and blood samples of the patients' siblings. By comparing the DNA in these samples, the Lilly researchers will try to pinpoint key genes. Once they isolate suspect genes, the ball comes back to the ECU court for experiments on the tissue to show how the genes work.

"This is not something any of us could do by ourselves," Dohm said. "They have a large capacity to analyze genes to see which ones are involved, which is something we couldn't do. At the same time, they don't have the patients, so it's only through making this kind of connection that you could ever do this kind of research. You've got to have all the components, or it won't work."

The scientists also are opening an inquiry into the causes of obesity. The National Institutes of Health, which has funded most of the research on diabetes and obesity, is considering a grant request for three separate but related studies. In particular, the team wants to examine the metabolism of blood lipids, a family of substances that include fats, oils and cholesterols. Earlier research has suggested that people become obese because their muscles fail to burn fat and instead send it to the adipose tissue for storage.

"We think there are some changes in lipid metabolism that really predispose people to become obese," Dohm said. "They have to take in more calories than they need, but when they do, the fat is directly shunted off to the adipose tissue." The researchers will examine why that happens—what prevents the muscle from burning the fat in the first place and why the adipose tissue is so eager to absorb fat.

One of those three projects, led by Dr. Hisham Barakat, will study differences in white and African-American women. African-American women have been shown to gain more weight, to put on weight at an earlier age and to have more difficulty in losing weight. They also deposit fat in different patterns than do white women. The issue is made more complex because the pattern of fat deposits in African-American women should offer some protection from cardiovascular disease, and they do indeed have lower cholesterol readings. Despite the lower cholesterol levels, African-American women die from heart disease in higher proportions than do white women. These factors hold true even when economic and cultural factors are taken out of the equation. Barakat will try to find out why.

"In the end, there may be implications for different therapies for blacks and whites," he said. "It may be we need different benchmarks of health, such as lowering what we consider to be safe cholesterol levels for blacks."

As the research continues, so do the surgeries. Since Pories developed the Greenville Gastric Bypass, he and other ECU surgeons have performed the operation more than 850 times.

In Pories, the patients find hope and compassion. "Most patients are so surprised that someone will listen and agree that they have a bad disease," Pories said. "They're used to being told they eat too much or they're lazy because they don't exercise."

Pories, too, sees cause for hope. "For the first time," he said, "we're beginning to see hope that we will be able to control diabetes better than we do today."

Dr. Michael Pfeifer checks the sensitivity in James Cooper's feet. Cooper suffers from diabetic neuropathy.

CLINICAL TRIALS ADVANCE TREATMENT OF DIABETES AND ITS COMPLICATIONS

James Cooper had brought his diabetes under control with a combination of oral medication and weight loss, but the pain in his feet refused to go away. The diabetes had caused nerve damage, called diabetic neuropathy. "I had very little feeling to the touch," he said. "I couldn't even distinguish cold, yet they hurt like hell. I would walk like I was 200 years old."

Then came what Cooper now considers "the best move I ever made." Through the Diabetes and Obesity Center at the ECU School of Medicine, he took part in a clinical trial of the topical drug Clonidine. The trial was designed to test the effective dose range and safety for Clonidine cream in the treatment of diabetic neuropathy. For five months, Cooper rubbed the cream onto his feet three times a day. Gradually, the pain subsided, and normal feeling returned. Cooper's recovery was so successful that after his initial trial, he was allowed to stay on Clonidine as part of a compassionate-use program while the pharmaceutical company awaits federal approval to market the drug.

"I even went to a powwow and danced awhile ago," said the Native American from Grimesland. "I could tell it the next day, too, but that had more to do with age than with my feet."

Cooper's story is one example of why the Diabetes and Obesity Center pursues a multi-million-dollar clinical trials program. In these carefully controlled studies, the center's doctors, staff and patients work with pharmaceutical companies and other researchers to test promising new therapies as part of the Food and Drug Administration's approval process.

"It's important for us to keep at the edge of what's going on," said Dr. Michael A. Pfeifer, the center's director and section head of the endocrinology and metabolism department of the School of Medicine. "We can bring to our patients the state-of-the-art therapy right away, often years before it's generally available. It also allows us to be at the edge and have experience with the most up-to-date treatments for teaching. That's part of what universities are supposed to do."

In the waning months of 1998, the center was participating in nine trials and had four more scheduled to start in early 1999. Some address diabetes itself while others offer potential help for complications of the disease. They included tests of several drugs for treatment of mild to severe diabetic neuropathy, one using commercially grown human skin to treat foot ulcers, another testing a drug to inhibit fat absorption to help patients lose weight, plus a trial of an inhaled form of insulin. Next spring, the center will participate in a trial of an automatic glucose testing device, which Pfeifer called the missing link in being able to develop an artificial pancreas.

Each trial must be approved by the medical school's human subjects review committee. "We're careful about the type of trial we do," Pfeifer said. "We're not interested in just getting money to run a trial. We want to know: Does it make a difference? Will it change the way we treat people? If the answer is yes, then it helps us bring things quicker to eastern North Carolina."

Pfeifer came to ECU in 1997 with an established reputation in clinical trials. Doug Allin, clinical research manager for Curatek Pharmaceuticals in Buffalo Grove, Ill., had worked on a project with Pfeifer 10 years ago at the University of Kentucky and followed his work through the years. When Curatek took on development of Clonidine, he sought out Pfeifer again, this time at ECU.

"He didn't let me down," Allin said. "We did a pilot study first. When you start a study, you figure the patients will drift in slowly. Within a month, he had all the patients enrolled. I was amazed at how fast he got going. And his staff people are always responsive. Everything is very timely." Pfeifer was quick to add more praise for his research staff—three nurses and two medical assistants—who, he said, do most of the work.

In addition to the potential benefits for the patients, Pfeifer said new therapies may make significant inroads on the costs associated with diabetes. Each year Medicare alone spends $30 billion to treat diabetes. Two-thirds of the total goes to treating the complications of the disease.

"There are studies that show that if patients followed currently recommended practices, we could decrease complications by as much as 85 percent in the next five years—without more research," he said. "The clinical trials have the potential for helping reduce complications even further."

(For news about Michael Pfeifer's new book on diabetes complication and other related publications, see page 37.)

SPACE AGE

NASA technology proves a good fit for interior design

An ECU professor has drawn on NASA technology to answer an important question in interior design.

"In interior design, we're concerned with planning living and working spaces to fit humans," said Dr. Patricia F. Lindsey, assistant professor in the Department of Apparel, Merchandising and Interior Design. "The anthropometric qualities are especially important in medical and elder care settings, but it really runs throughout everything we do."

The challenge is to be able to preview the architectural elements of a design in a way that allows the designer and client to test the fit. Is the sink placed at a comfortable height for an elderly woman bent by osteoporosis? Will people bump into cabinets as they turn corners? Computer-rendered three-dimensional drawings improve on the traditional tools—perspective drawings and scale models—but still fall short of the goal. A NASA fellowship allowed Lindsey to test a newer method.

Since 1993, Lindsey has spent four summers at the Marshall Space Flight Center in Huntsville, Ala., testing the use of virtual reality as a design tool. Created through sophisticated computer programs, virtual reality simulates a three-dimensional environment in what appears to be actual size and gives the user or users the feeling of being in and moving through the environment. The experience comes courtesy of NASA's Summer Faculty Fellowship Program, which brings about 50 university faculty members to its Huntsville facility each year to work alongside its own researchers.

The first year, NASA had Lindsey create a virtual reality version of its payload operations control center. She then compared responses of people using the real and virtual versions of the center. She published an article expanding on her findings in the spring 1998 issue of *The Journal of Interior Design*. In her later stints in Huntsville, Lindsey created other virtual environments for NASA's use, including a redesign of its own virtual reality laboratory.

"The purpose was to see if virtual reality answers the same questions as a real-size model and whether virtual reality can be used for prototyping interior environments," she said. "And indeed, you see the same things. But there are several problems that haven't been solved. It's expensive, especially in time, to make virtual reality look just like reality. Otherwise, you get a sort of cartoonish look. We also haven't found a good way to get tactile feedback, but it is good for estimating visibility and spatial relationships."

Lindsey has built on her contacts at NASA to present advanced interior design students with a real-world problem. The students, in a 3-D computer-aided design course, have tried to solve problems in the design of the living quarters of the international space station, such as creating space-efficient work surfaces and indicating up from down in a micro-gravity environment.

Her next challenge may be the most difficult yet. She wants ECU to become one of only a handful of universities with its own virtual reality equipment. A top-of-the-line setup carries a $1 million price tag.

NASA's Marshall Space Flight Center gave Dr. Pat Lindsey an opportunity to put virtual reality to the test.

TAKES 2

PHOTO BY DANA EZZELL GAY

PART ODD COUPLE, PART DYNAMIC DUO, ECU SOCIAL SCIENTISTS MAKE THE MOST OF COMPLEMENTARY TALENTS

As surely as a nor'easter erodes the shoreline, rapid development is changing the face of North Carolina's coastal counties. Wealthy retirees move in, placing new demands on local health care systems. Sport fishermen compete for a dwindling ocean catch with families who have made their living on the water for generations. Hotels scour the countryside in search of desk clerks, maids and waiters to serve the bustling tourist business.

In the Institute for Coastal and Marine Resources, two social scientists noted for their contributions to fisheries management have turned their minds to the problems and pressures of coastal development. "The coast is a lot more complex than just fisheries and fishing," said Dr. David C. Griffith.

Griffith and his long-time collaborator, Dr. Jeffrey C. Johnson, have begun a research initiative to examine problems arising from the growth of ports and harbors, hotel tourism, ecotourism and seasonal retirement communities. How, they ask, will these industries compete for space, labor, resources and political influence? Already in the Albemarle Sound area, ecotourism has run headlong into established fishing and hunting clubs opposed to sharing the waterways. And as hotels on the Outer Banks bus in low-wage service workers from Elizabeth City, Griffith sees problems in the making. ›

IT TAKES TWO

"Look at Florida, where this process is already advanced," he said. "You end up having ghettos where people live who service the big luxury hotels, and they're out there only during the day. It's sort of like an apartheid situation. So along with this coastal development, you have people being marginalized and ghetto development going on at the same time. That creates all kinds of problems for inland counties that are near the coast."

Pressure also increases on traditional coastal industries. "Part of the story is what's happening to commercial fishing," Johnson said. "In rural eastern North Carolina, that's traditionally been one of the primary sources of income for a lot of people. Our purpose is to identify where there may be problems and make people aware of where the problems lie."

The coastal development project, still in the early stages, is the latest in a 15-year history of collaboration for Johnson and Griffith. At first they seem an unlikely duo. Johnson is big, loud and passionate about numbers. Griffith is soft-spoken and easygoing, more prone to literary references than statistics. Close up, the lines blur. Although he is based in the sociology department, Johnson's training includes anthropology, and he frequently publishes articles in anthropology journals. Griffith holds degrees in anthropology, but his books and papers are widely read by rural sociologists.

"We're social scientists, and we don't see boundaries," Johnson said. "We see problems, and we want to study those problems. Often interdisciplinary work is the best way to approach them."

Their peers see added strength in the collaboration of two individually strong scientists. "Jeff Johnson is one of the few quantitative anthropologists in the world," said Dr. B.J. Copeland, a professor of zoology at North Carolina State University. "But things aren't always quantitative, and David keeps you oriented to the social and cultural aspects. That's where David and Jeff working together are so important—in the interpretation. Both have contributed considerably to our understanding of social and economic structure of coastal communities."

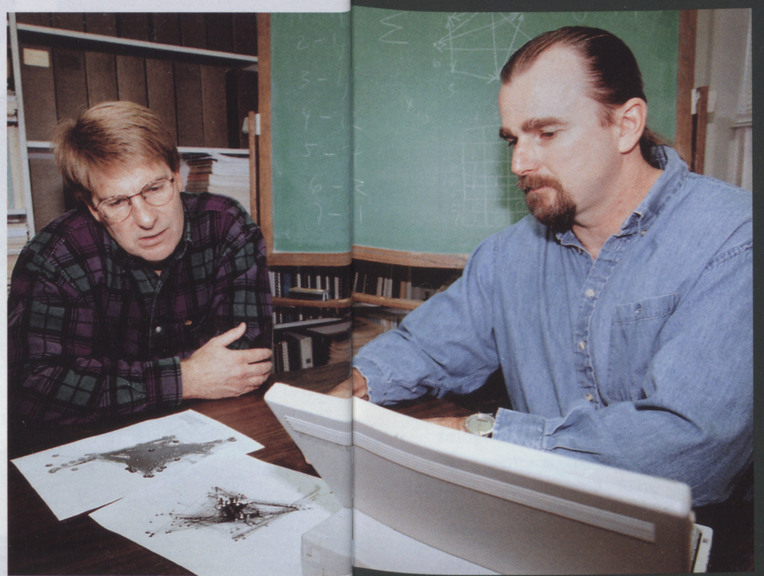
Jim Murray, associate director for outreach of the National Sea Grant Program, first worked with Johnson and Griffith when he was director of extension for North Carolina Sea Grant. "They've always been on the cutting edge with regard to creativity and risk-taking," Murray said. "Jeff was way out in front with his ability to turn social science research, specifically marine anthropology, from what historically has been qualitative work into quantitative research. This was 16 years ago, at a time very few were doing it. He set the precedent, and his name is synonymous nationally for quantitative techniques.

"One of the things that makes them such a good team working together is that their skills are complementary. Jeff is great at conceptualizing, at developing the methodology. David's great at operationalizing, doing the field work, collecting the data to make the methodology work. I truly believe they're leaders in their field. ECU is recognized as a, or the, national leader in marine anthropology, and a large part of the reason is Jeff and David."

The collaborations started in 1983 with a project designed to interest recreational fishermen in underutilized fish, such as shark, amberjack and sheepshead. The idea was to reduce pressure on the stock of more popular fish. Drawing on the precedent of market researchers, Johnson and Griffith used linguistics and semantics, first, to understand how people perceived fish and then to create a more desirable image for underutilized species. Throughout the project, they worked alongside Sea Grant extension specialists, producing both academic articles and 31 educational products—brochures, posters and cookbooks—targeted at fishermen.

> "YOU WANT TO HELP THE WORLD, BUT YOU ALSO WANT TO BE ABLE TO PUT FORTH IDEAS," JOHNSON SAID. "ALMOST EVERY ONE OF OUR PROJECTS HAS BOTH AN ACADEMIC COMPONENT AND AN APPLIED, OR PRACTICAL, COMPONENT. I WOULDN'T DO SOMETHING THAT DIDN'T HAVE BOTH."

They succeeded so well that sharks and amberjack have been removed from the underutilized list, and sharks are actually in danger of being overfished. "What happened was, when it went to being recreational, it also became commercial," Johnson said.



Drs. David Griffith, left, and Jeffrey Johnson liken their collaborative process to tag-team wrestling.

Since that first successful project, Johnson and Griffith have kept at least one mutual collaboration among the four or five active projects each is juggling at any one time. Also among the lot will be collaborations with other scientists, including biologists and economists, and some solo work. Griffith, for example, is directing a national study of labor issues related to a special class of work visas. Johnson has been running a study of people in isolation since 1991. His research subjects—scientists overwintering in Antarctica. On joint projects, they have tackled such issues as public perceptions of seafood safety, the effects of fishing policy on families and communities, conflicts among fishermen and public perceptions of environmental risks.

"People are pretty bad about judging risks to the environment and to themselves from the environment," Griffith said. "E. coli is a classic example. E. coli kills just a handful of people every year. Even if 9,000 people die from food-related exposure, that's out of 750 million exposures and it says nothing about who's dying or whether they had pre-existing conditions or whether they were really stupid about food handling. Your risks of dying in a car accident are much higher than dying from eating stuff."

Concern over the toxic dinoflagellate *Pfiesteria piscicida* falls into the same category and shows the harm in public misperception, he said. "The problem is, when people misunderstand or exaggerate certain environmental risks, they encourage politicians and other people to essentially divert resources and time to look at these issues when, in fact, we know there are these real environmental risks, like lead poisoning, rabies, PCB and problems in the food supply," he said. "But if all this attention gets focused away from them and onto some phantom environmental risk like pfiesteria, well, then that's just a total waste of public funds. In terms of practical outcomes, that's how we would hope to influence them."

Their research sometimes tries to calm waters so that opposing groups may eventually reach consensus. Such was the case when they conducted in-depth interviews about environmental problems with recreational and commercial fishermen. While the two sides pointed to different causes (generally each other) for existing problems, both held the same ideals. They wanted a clean environment and plentiful resources. In the consensus lies a starting point for public policy discussions.

Such practical applications can be found in most projects Griffith and Johnson take on. "You want to help the world, but you also want to be able to put forth ideas," Johnson said. "Almost every one of our projects has both an academic component and an applied, or practical, component. I wouldn't do something that didn't have both."

The two have worked together so long that they often finish each other's sentences, sometimes pausing for the other to add a salient point. They liken the collaborative process to tag-team wrestling. One works awhile, then hands off to the other. Back and forth they go until the project is finished. Complementary strengths and trust that each will carry his weight make the collaboration work. So does mutual admiration.

"Jeff's a lot better at analysis than I am," Griffith said.

"David's quite good at conceptualizing some ideas, at thinking through how you collect data and, particularly, at writing," Johnson said, adding with a touch of awe, "He's not only good at writing, but he likes to write. My thing is analysis."

Even as both bemoaned a backlog of intended publications, Johnson and Griffith also laid out plans for a new study. This one, involving biologists and sea ice experts, will take them to the Arctic to compare the environmental knowledge of scientists and Native Alaskan whalers. They hope to show scientists how to make use of the accumulated knowledge of the fishermen.

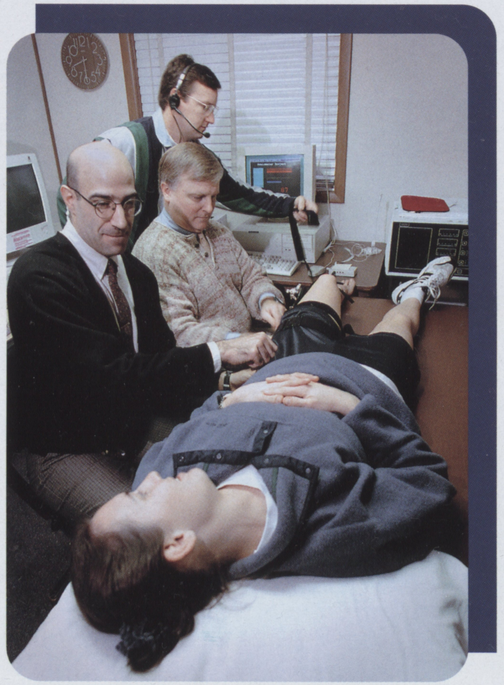
"The whaling captains have some knowledge about how the ice works and other things, and maybe their knowledge is useful for scientists so they can figure out where to put their experimental stations, how best to use their resources to collect data, things like that," Johnson said. "What you have to be able to do is show that even though [the fishermen] are not doing things in a scientific way, they're valid in some of the things they've observed. Once you can model something, once you can show scientists how people are thinking and the logic behind it, it makes it easier to be able to compare."

BACKGROUND PHOTO BY DANA EZZELL GAY

Early studies show telemedicine compares well with doctor's visit

Quality Care

In some of the first studies of the efficacy of telemedicine, School of Medicine faculty are asking whether telemedicine consultations give patients the same quality of medical care that a visit to the doctor's office provides. The early answer is a qualified *yes*.



Dr. Donald Shaw, wearing tie, explores whether telemedicine can be used to deliver physical therapy. Helping him test an electronic goniometer are Ashley Pace, David Gabriel and Allen Lawson.

"This is one of the undone pieces of telemedicine," said dermatology assistant professor Dr. Charles M. Phillips. "There's been a lot of enthusiasm for telemedicine, but nobody has any idea if it's good in all applications. As a clinician, that's important."

Telemedicine uses networks of computers, video cameras and telephone lines to link patients with physicians and other medical practitioners. Electronic stethoscopes and other specialized tools aid diagnosis. It has been hailed as an especially promising way to provide cost-effective specialty care to people living in remote regions. Because patients and hometown physicians can confer with distant specialists without leaving their neighborhood, telemedicine saves time and travel.

The ECU School of Medicine, which serves 29 predominantly rural counties in eastern North Carolina, is recognized as an international leader in telemedicine. It has established a network for providing clinical and educational programs to 12 remote sites—including six small hospitals, Central Prison in Raleigh and five clinics. Since the program was established in 1992, School of Medicine specialists have provided more than 2,000 telemedicine consultations.

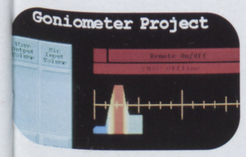
"Everybody would like to have controlled studies, but they're more important in some applications than in others," said Dr. Susan Gustke, medical director of the ECU telemedicine program. "Some applications we know will work because they're similar to others we're using successfully. But even if the specialist is very confident, controlled studies help us convince the agencies paying for medical care that this is a valid delivery system and should be used. Another purpose of the studies is to make referring doctors feel comfortable with the results."

To test telemedicine's applications in dermatology, where a good view of a suspect lesion or mole might be critical, Phillips and some colleagues set up a study in which 60 patients were seen in person by one dermatologist and over an interactive video network by another dermatologist. The two consultations took place on the same day but independently of one another so each physician was unaware of the other's diagnosis. Later comparisons showed they agreed on a diagnosis 77 percent of the time.

"Some studies since then of 'live' dermatologist to 'live' dermatologist show 80 to 90 percent agreement, so we're in the ballpark," Phillips said. "The comfort level (with the technology) gets down to the individual patient. I may see a patient and not be sure what's going on. If it's a telemedicine consultation, there's a nagging question: Is it because of the technology? But in most cases, when I've seen that patient live, I still wasn't sure."

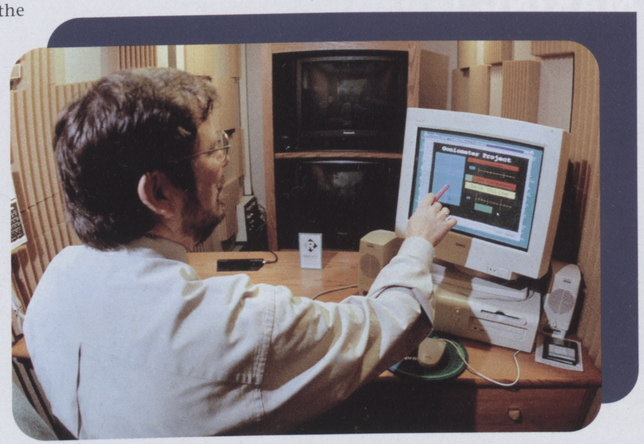
The study was published in the September 1997 issue of the *Journal of the American Academy of Dermatology*. Since then, Phillips said, better cameras have been installed on the telemedicine network. "That's one of the problems in this area," he said. "As soon as you do a study, the technology advances."

Dr. Michael E. McConnell, a pediatric cardiologist and associate professor, led a study similar to Phillips's, to compare the results of cardiologists' examinations of 21 children suspected of having heart murmurs. "We found that telemedicine was reasonably accurate," he said. In two cases, though, the telemedicine consultant failed to properly diagnose murmurs, caused by small holes in the heart. In both instances, the holes closed on their own without symptoms within six months.



"For the person looking at this," McConnell said, "the question is: Is missing two small holes acceptable?" When he presented his findings at a meeting of the American College of Cardiology in April 1998, reaction was generally favorable. McConnell, however, remains cautious. "When I see a patient via telemedicine, I now realize it's not a sure thing," he said. "I have a higher index of suspicion and might do an echocardiogram when I otherwise wouldn't, or I might ask them to drive down to see me."

Meanwhile, in fall 1998, physical therapy professor Dr. Donald Shaw launched the first phase of a trial that may lead to a new application for telemedicine. "If folks live in rural settings and can't get to a physical therapist, maybe we can take the physical therapist to them," he said.



Alan Branigan of the Center for Health Sciences Communication checks goniometer readings from Shaw's experiment.

As a first step, he needed to see whether he could get accurate readings of joint angles over the telemedicine network. Joint angles indicate range of motion, which clues physical therapists into a patient's ability to carry out day-to-day tasks. To do this, he strapped a knee brace equipped with an electronic goniometer, which measures angles, onto a leg of healthy student volunteers. Readings from the goniometer were transmitted over phone lines to a computer in the physical therapy department. At the same time, a physical therapist also took a direct measurement of the joint angle for comparison. If the readings on healthy knees prove accurate, Shaw said his next step will be to test the electronic goniometer on people with problem joints.

More and larger studies will help health-care professionals better assess the merits of telemedicine applications, but such research is likely to be slow in coming. "Finding funding is probably the major limitation to this research," Gustke said. "Most telemedicine funding has gone to getting the networks up and running. We looked long and hard to find the money for these efficacy studies."

UPBEAT

FOR MARIMBIST MARK FORD, MAKING MUSIC MEANS HAVING FUN

"Wow, they pay me to do this," says Mark Ford, associate professor of music, composer and concert marimbist. At far left, he is pictured with his band, Panama Steel.

MARK FORD, ASSOCIATE PROFESSOR OF MUSIC, proved to be a musical innovator early on. "When I was 5 or 6 years old, I had long green Tinkertoys, and I'd take the Tinkertoys out with my brother's Beach Boys album and knock on all the Army helmets," he says. "I'd have a whole string of rhythms going on there."

In succeeding years, Ford has progressed from playing back-up helmets on *Little Deuce Coupe* to solo marimbist, performing his own compositions in concerts around the country and on his 1996 debut CD *Polaris*. He also directs the School of Music's touring group, the East Carolina Percussion Ensemble, which earned one of two performance spots for student orchestras last fall at the annual Percussive Arts Society International Conference. During his off hours, he leads the popular Panama Steel, a student-based professional steel drum band he organized 10 years ago. He's an entrepreneur to boot, a founder and vice president of Innovative Percussion in Nashville, Tenn., one of the leading companies making mallets for marimba, vibraphone and xylophone.

Between his solo and ensemble work, Ford may be onstage three or four nights a week for long stretches at a time. He loves every minute. "Wow, they pay me to do this!" he says. "Every week is different. I get to work with wonderful people, both in the school here and other artists and musicians around the state. And what I play is a part of me. I have a love of life, and I want to share that through the music."

In a guest artist concert in Chapel Hill, he keeps his audience entranced with a mixture mellow and mirthful. First comes the haunting, ethereal melody of the title track from *Polaris*, his own composition. Later, he throws in a steel-drum rendition of an Irish jig. He concludes by having two students join him on *Stubernic*, a piece he composed for three marimbists on one instrument. They play the keys, sides and a little bit of air as they rotate around the marimba. "It's a bizarre situation," he admits. "I had dreamed of people dancing behind the marimba."

In its choreography, *Stubernic* has a touch of Ford's first and most famous composition, *Head Talk*, a piece several music publishers didn't think would ever fly. It calls for five drummers to sit on the floor playing drum heads (not drums, just the heads) and tossing them back and forth. Ford, a pack rat, had been inspired by a closet full of used heads. Since he wrote it in 1987, *Head Talk* has been performed around the world, including performances last year in Russia, Taiwan and Brazil. "In concerts and clinics, I'll hear someone say, [loud whisper] 'That's the *Head Talk* guy.' It's only a five-minute piece, but it's a crowd pleaser because it's entertaining and very visual. And drummers love it because they don't have to cart anything. They can put their drum heads under their arms and go."

Ford premiered his newest composition, *Motion Beyond*, in the fall of 1998 and in spring 1999, will premiere the *Suite for Five-Octave Marimba* by another highly regarded composer, Richard Maltz. "Most of my repertoire lately has been a good portion of my own composing, which is good for me because I'm able to get my music out to an audience," he says, "but I don't want to play just my own music in concerts. I enjoy a variety of music in a recital."

His ensemble work alternates. Panama Steel will play 50 to 60 concerts between April and October. The group performs throughout the Carolinas and Virginia and has made three recordings. From October to April, Ford focuses on the Percussion Ensemble, a laboratory group of advanced students that is working on its second CD. The first, with ECU tubist Jeff Jarvis, was released in January 1999 on the Arizona University Recordings label. This CD also features several duets with Ford and Jarvis.

Since he founded Panama Steel in 1988, about 40 student musicians have played with the group at various times. Each year he holds auditions to replace those who have graduated. "I try to choose individuals who will connect with others in the group, who have the talent and desire to take something to a new level," he says. But it takes more than desire to keep them going through rehearsals, performances and all the hours spent traveling. "I don't think any of us would do this for money if it weren't fun," he says.

For Ford, it's all fun—marimba, steel drum, vibes, performing, composing. "If, for some reason, the school thing went away, I'd still be playing drums," he says. "I may be on the street playing music with a hat in front of me, but I'd be doing something in this vein. I don't think I could stop."

Mallets vibrate as Ford demonstrates the marimba. At lower right are mallet heads made by the company Ford co-founded, Innovative Percussion.

SEAMLESS

EMOTIONALLY DISTURBED CHILDREN BENEFIT AS NEW APPROACH TO CARE TAKES HOLD

ECU IS PLAYING A MAJOR role in a national movement to improve services for children with serious emotional problems and their families. Seven faculty members, plus staff and graduate students, have helped shape a demonstration project that has won national recognition.

The project, called Pitt Edgecombe Nash-Public Academic Liaison (PEN-PAL), originated in 1994 with a four-year, $5 million federal grant to the Child and Family Services Section of the North Carolina Division of Mental Health. It was one of two dozen grants designated for demonstration projects that would improve community-based services for children with serious emotional problems and reduce the need to place the children in hospitals or other institutions.

PEN-PAL serves about 400 children who suffer from such problems as attention deficit disorder, oppositional and defiant disorder, anxiety and depression. It works by pulling together multi-agency teams of service providers, along with parents and community organizations, to create a seamless system of care for affected children. Previously, each agency involved with the child—social services, schools, mental health agencies and the juvenile justice system—worked independently, sometimes resulting in several intervention plans for a single child. PEN-PAL also tries to build on the strengths of the individual children, their families and communities, for example, taking advantage of a child's interest in sports or a family's involvement in church.

"It's gone remarkably well, but it's also been more of a challenge than any of us imagined," said Martha Kaufman, PEN-PAL project manager for Child and Family Services. "In a lot of ways, we're trying to change the world."

The difficulties have been compounded by reforms in welfare, education and health care, said Dr. Susan L. McCammon, ECU associate professor of psychology. "Agencies have so many conflicting demands that are simultaneous," she said. "In today's climate, people in social services and mental health need to produce and produce quickly. That's not compatible with restructuring."

ECU faculty have provided training, resources and technical assistance for services providers. The university also has created an interdisciplinary course that is based on the system of care concept and brings parents of emotionally disturbed children into the classroom as faculty. The ECU team is as diverse as the children the project serves. McCammon, from psychology, and Dr. Betty Beacham in education have coordinated ECU's participation in PEN-PAL. Other faculty involved include Dr. Dorothea S. Handron in nursing, Dr. David A. Dosser Jr. in marriage and family therapy, Dr. John Y. Powell in social work, and Dr. John M. Diamond and Dr. Kaye McGinty of the School of Medicine.

Stephanie Brown, director of student services for Nash-Rocky Mount Schools and a member of the PEN-PAL project management committee, praised ECU's contributions. "They're on the cutting edge of where we need to be going," she said. "They've done a tremendous job of sensing our needs and designing in-service training to suit those needs."

Of all the funded projects, only PEN-PAL tied its program to a university. Kaufman said ECU's leadership created a framework that allowed the project to build logically. "Otherwise, we'd just learn by doing," she said. "Also, Dr. Lenore Behar [Child and Family Services Section chief] felt from the beginning that it was important to get a university involved so rather than our spending years and years trying to retrain professionals, we're partnering with the university to change the way they teach students who will become professional service providers."

Outside evaluators have noted improvements in children participating in the PEN-PAL program. In measurements taken six months and one year after entering the program, the children on average show higher academic performance and fewer behavioral problems. Their parents report greater satisfaction, too.

Because of this success, PEN-PAL was selected for presentation before a congressional panel in May 1998. PEN-PAL and ECU also have been featured in four national professional publications. In addition, McCammon and Powell were invited to serve on the faculty of a national institute for redesigning care programs for emotionally disturbed children.

in print

Book on Fred Chappell's poetry nominated for two awards

When one poet examines the work of another, the results can be impressive. **PATRICK A. BIZZARO**, poet and associate professor of English, assembled the first critical assessment of the poetry of North Carolina's poet laureate in a book titled ***DREAM GARDEN: THE POETIC VISION OF FRED CHAPPELL*** (LSU Press, 1997). A collection of essays, the book was nominated for two awards in 1998—the James Russell Lowell Award of the Modern Language Association and the Hugh Holman Award from the Society for the Study of Southern Literature.

Contributors to ***DREAM GARDEN*** included Pulitzer prize-winning poet Henry Taylor, other internationally known figures such as Dabney Stuart and Robert Morgan and ECU faculty Resa Crane, James Kirkland, Peter Makuck and Alex Albright.

Other new books by ECU faculty range from the erudite to whimsical. Faculty also serve at the helm of several respected journals.

Credit for one of the most complex and unusual undertakings belongs to **DR. CHARLES FANTAZZI**, Whichard professor of classics. Fantazzi is deeply involved in a long-range project by the University of Toronto Press to publish an 85-volume English translation of the ***COLLECTED WORKS OF ERASMUS***. The 16th-century Dutch humanist played key roles in the development of the Christian church and in education through his writings, translations of the New Testament and influential friendships. Fantazzi has translated and annotated five volumes, including the 1998 release of the second volume of ***ON THE EDUCATION OF THE CHRISTIAN WOMAN***. He has completed a translation of volume 13 of the ***CORRESPONDENCE OF ERASMUS*** and begun work on volume 14. Erasmus wrote in Latin, the language of scholars in his day.

On the lighter side, **DR. WILLIAM HALLBERG**, golfing enthusiast and associate professor of English, celebrated new releases in 1998 of three previously published books. ***THE SOUL OF GOLF***, first published in 1997 by Fawcett, has been reissued in paperback by Ballentine. For this book, Hallberg traveled the country to try out an assortment of golf courses. He writes about his travels, his golf game, the people he met along the way and life in general. In addition, Ballentine brought out a paperback edition of Hallberg's novel ***THE RUB OF THE GREEN***, and Simon and Schuster issued a paperback version of his edited collection ***PERFECT LIES: A CENTURY OF GREAT GOLF STORIES***.

The Obesity and Diabetes Center of the School of Medicine has become headquarters for several important publications. **DR. MICHAEL A. PFEIFER**, director of the center, edited ***DEAR DIABETES ADVISOR*** and co-edited ***THE UNCOMPLICATED GUIDE TO DIABETES COMPLICATIONS***, both of which were published by the American Diabetes Association. ***DEAR DIABETES ADVISOR***, subtitled ***PLAIN AND SIMPLE ANSWERS TO YOUR QUESTIONS ABOUT DIABETES***, came out in 1997. ***THE UNCOMPLICATED GUIDE*** followed a year later. Acknowledging that people with diabetes are living longer lives, it gives diabetic people and their families a thorough understanding of many complications that may ensue and ways to prevent and treat these complications. Topics range from disorders of the feet to sexual health and eye disease.

Pfeifer and his ECU colleague, **DR. ROBERT TANENBERG**, also have taken over as editors of the American Diabetes Association's two major lay periodicals. Tanenberg edits the ***DIABETES ADVISOR***, a bimonthly newsletter in brief, read-at-a-glance format. Pfeifer is editor of ***DIABETES FORECAST***, a monthly newsletter with longer articles. (For articles on diabetes-related research and clinical trials, see pages 22–27.)

On the literary front, assistant professor of English **DR. MARGARET D. BAUER** assumed editorship of the ***NORTH CAROLINA LITERARY REVIEW*** in 1998. She follows in the steps the journal's founding editor and another ECU faculty member, Alex Albright.

The annual journal is a publication of the North Carolina Literary and Historical Association.

Among other recent publications

HARDAWAY REVISITED: EARLY ARCHAIC SETTLEMENT IN THE SOUTHEAST (UNIVERSITY OF ALABAMA PRESS, 1998) BY I. RANDOLPH DANIEL JR.

Daniel, associate professor of anthropology, revisits one of the most famous Early Archaic archaeological sites in the southeastern United States, North Carolina's own Hardaway site. Located near Badin in Stanly County, the Hardaway site provided early hunters and gatherers with a base camp from which to exploit the stone outcrops of the nearby Uwharrie Mountains. Daniel proposes that it was the availability of high-quality stone that determined the location of the settlement. Previously, scholars have asserted that people in the Early Archaic period (9,000 to 10,500 years ago) concentrated along the major southeastern river valleys to take advantage of food resources. (See page 8 for an article on Daniel's current project.)

THE NORTH CAROLINA SHORE AND ITS BARRIER ISLANDS: RESTLESS RIBBONS OF SAND (DUKE UNIVERSITY PRESS, 1998) BY STANLEY R. RIGGS, ORRIN H. PILKEY, WILLIAM J. NEAL, CRAIG A. WEBB, DAVID M. BUSH, DEBORAH F. PILKEY, JANE BULLOCK AND BRIAN A. COWAN.

This volume follows up on the groundbreaking 1978 book *From Currituck to Calabash*. In the earlier book, Riggs, ECU geology professor, and Duke University's Pilkey outlined the hazards of building on North Carolina beaches. *The North Carolina Shore* provides a detailed analysis of the two decades of change since then, covering all that nature and man have wrought, improvements in mapping techniques and regulatory changes.

LEE MOVES NORTH: ROBERT E. LEE ON THE OFFENSIVE (JOHN WILEY, 1998) BY MICHAEL A. PALMER.

This book analyzes Gen. Lee's three strategic offensives—the Maryland campaign of September 1862, the Gettysburg campaign of June–July 1863 and the Bistoe Station campaign of October–November 1863. Lee lost all three offensives, and Palmer, associate professor of history, highlights the elements of Lee's generalship that contributed to his failure.

NONLINEAR TIME SERIES ANALYSIS OF ECONOMIC AND FINANCIAL DATA (KLUWER ACADEMIC PUBLISHER, 1998), EDITED BY PHILIP ROTHMAN.

Rothman, assistant professor of economics, pulled together 16 previously unpublished papers by economic specialists in the field of nonlinear time series analysis. Rothman is a contributor as well as editor.

SERIOUS PLAY: THE CULTURAL FORM OF THE NINETEENTH-CENTURY REALIST NOVEL (UNIVERSITY OF PENNSYLVANIA PRESS, 1999) BY JEFFREY FRANKLIN.

Franklin, assistant professor of English, takes a look at gambling, theatricality and aesthetic theory as they are presented in Victorian society and novels. He focuses on novels by Charlotte Bronte, George Eliot, Charles Kingsley, William Thackeray and Anthony Trollope. Along the way, he develops a new theory of the novel as a cultural form and revises the definition of realism. The book was published as part of the New Cultural Studies Series.

STRUCTURALISM'S TRANSFORMATIONS: ORDER AND REVISIONS IN INDONESIA AND MALAYSIA (ARIZONA STATE UNIVERSITY CENTER FOR SOUTHEAST ASIA STUDIES, 1999), EDITED BY LORRAINE V. ARAGON AND SUSAN RUSSELL.

In the book's introduction, Aragon, visiting professor in the ECU anthropology department, discusses the history of structural and post-structural theoretical analyses of Indonesian and Malaysian cultures. The volume then presents 13 new ethnographic contributions concerning Indonesian and Malaysian cultures by U.S., Canadian, British, Dutch, Australian, Japanese and Indonesian authors. Aragon's co-editor, Russell, is on the faculty of Northern Illinois University.

YOUNG ADULT SCIENCE FICTION (GREENWOOD PRESS, 1999), EDITED BY C.W. SULLIVAN III.

This collection of essays by various experts examines science fiction written for the young adult market. It approaches the topic with overviews of young adult science fiction from different countries and with articles on specific topics, such as women or war, in these young adult books. The final section is a massive annotated research bibliography. Sullivan, professor of English, also edited Greenwood's 1993 volume *Science Fiction for Young Readers*, which focuses on specific authors.

Partnership to investigate issues in welfare reform

Responding to the growing complexity of issues facing social workers, the School of Social Work and Criminal Justice Studies and the N.C. Association of County Directors of Social Services have established the Partnership for Human Services. Its purpose is to link the resources of the university with the needs of human services agencies in local communities.

The partnership officially kicked off in May 1998 with a $700,000 contract from the N.C. Division of Social Services to conduct five research and curriculum projects. The projects include examinations of Work First welfare reform issues and methods to reduce the backlog of cases involving termination of parental rights. New training programs are being developed for workers in child protective services. Most of the projects are scheduled for completion in 1999.

Executive director Myra Powell and a five-person staff run the partnership under the auspices of the School of Social Work and Criminal Justice Studies and contract with school faculty to carry out projects. Oversight is provided by an executive committee composed of six social services directors and three social work faculty not involved with individual projects. An advisory board from outside the sponsoring agencies also is being established.

Faculty leading the first set of projects are Dr. Reginald O. York, Dr. Vickie D. Causby, Dr. Lessi L. Bass, Joyce G. Reed, Dr. Paul E. Knepper and Dr. Mary S. Jackson. Research assistance is provided by social work lecturer Shelia G. Bunch and by Sara Davis and Beverly J. Brooks of the partnership staff.

In addition to the state contract, the partnership has signed four contracts to provide technical assistance to individual county social services departments.

Biomedical physics admits first Ph.D. students

ECU's newest doctoral programs are getting off to a fast start. Biomedical physics admitted four students in its first class for fall 1998, and coastal resources management is on track to admit 10 to 12 students in fall 1999. The UNC Board of Governors approved both programs in early 1998.

Meanwhile, ECU awarded 307 graduate-level degrees, including 17 doctorates, in 1998. Approximately 2,900 graduate students and 300 professional-degree students are enrolled.

The biomedical physics program trains scientists in the complex interactions between the physical and biological worlds, preparing them to understand and develop advanced medical technologies. These would include such devices as laser beams, ultrasound, x-ray and electromagnetic radiation equipment. Students will study physics, biology, chemistry and medicine.

Dr. Mumtaz Dinno, chair of the physics department, directs the program. Although based in the physics department, the program is a collaboration of the College of Arts and Sciences and the School of Medicine, in particular, the departments of radiation oncology and physiology.

Dr. Lauriston R. King joined the ECU faculty in spring 1999 to direct the coastal resources management program. He comes to ECU from the University of Southern Mississippi, where he was director of research and sponsored programs. Before that, he had worked at Texas A&M University as deputy director of the Office of University Research and deputy director of the Sea Grant Program and at the National Science Foundation's Office for the International Decade for Ocean Exploration. He is a past president of the National Coastal Society and has served on the executive committee of the Marine Affairs and Policy Association.

The coastal resources management program is designed to advance scientific knowledge of the Earth's oceans and adjacent coastal environments, with an emphasis on using scientific knowledge in the management of coastal and near-shore marine resources. It will draw on the expertise of faculty in seven academic disciplines—anthropology, biology, economics, geography, geology, political science and sociology. It is based in the Institute for Coastal and Marine Resources. Within months of its approval, about 50 inquiries had been received from eight states, Canada and India.

Another new program, the Ph.D. in communication sciences and disorders, will graduate its first student in 1999. The university also anticipates receiving approval from the Board of Governors to admit students to the new doctoral program in bioenergetics in the fall of 1999.

Technologies move closer to market

Medical technologies lead the list of ECU innovations under review in the Office of Technology Transfer.

The office reviews faculty inventions, files patent applications and helps move university technology into the marketplace through licensing agreements and spin-off private enterprises. The office also encourages multidisciplinary collaborations within the university and collaborations with private companies.

Innovations under review include:

• An anti-stuttering device. Three ECU researchers in the Department of Communication Sciences and Disorders have identified a process that greatly reduces stuttering and frequently eliminates it. When a stutterer speaks, the cells responsible for communication receive too many signals and basically short out, producing the stutter. This new device uses headphones and a sound board to redirect electric signals in the brain. ECU researchers involved in the project are Drs. Joseph Kalinowski, Michael Rastatter and Andrew Stuart.

• Pediatric Heart Sounds CD-ROM. This interactive computer application is designed to help general medical practitioners and medical students learn to distinguish between normal and abnormal heart sounds in children. It allows users to listen to heart sounds in four areas of the chest, closely simulating a physical exam, and to learn more about congenital heart problems. Additional interactive text, illustrations and a self-test are included. The program was developed by Dr. Michael McConnell, a pediatric cardiologist at the medical school, and Alan Branigan of the Center for Health Sciences Communication.

• An alternative to mammography. Although still in the early stages of development, this technology holds the potential to improve on mammography as a screening device for breast cancer at lower cost than current alternatives. The device uses a continuous-wave laser beam to create high-resolution images. It is being developed by Dr. Xin-Hua Hu of the physics department.

• Telemedicine kiosk. This stand-alone information booth could put health information into shopping centers, hotel lobbies and airports. Based on interactive computer programming, it allows users to obtain medical information from self-contained software packages or over the Internet. Diagnostic tools such as blood pressure cuffs and telecommunication links can provide live consultations with medical practitioners. The kiosk has been developed by the Center for Health Sciences Communications under the direction of David C. Balch.

ECU implements state-of-the-art research administration

The Office of Sponsored Programs cannot claim to be paperless, but the day may come, thanks to a nationwide trend toward electronic research administration, or ERA.

ERA saves time and money by enabling ECU faculty members to submit grant proposals to sponsoring agencies electronically, automating necessary accounting and reporting functions, and transmitting information to sponsors on-line instead of by mail. Traditionally, research management has depended on moving reams of paper.

As part of this movement, ECU is collaborating with major universities around the nation in pilot projects testing electronic administration initiatives by federal agencies, such as the National Institutes of Health. The Office of Sponsored Programs also has taken the lead in promoting campuswide electronic sharing of financial information and is assisting other UNC campuses in entering the electronic era of grant and contract management.

Grant and contract activity increases

Total grant and contract activity at ECU continued its steady climb in 1997–98. More than 400 faculty participated in submitting 542 proposals requesting almost $68 million in external funding. Faculty received 441 grants and contracts, totaling more than $28 million, a 9 percent increase over 1996–97. The university was third among the 16-campus UNC system in external funding.

Just more than half of this funding (51 percent) supported projects in public service, with 37 percent going for research and 10 percent for instruction and training. Clinical trials of new treatments for disease maintained a steady increase, going up by almost 15 percent over last year. Government (federal, state and local) accounted for 64 percent of funding. Business and industry sponsored 20 percent, foundations and nonprofit agencies supplied 13 percent, and other organizations sponsored 3 percent.

Grants and contracts generate resources, over and above state appropriations, for projects that benefit eastern North Carolina and the state. Some examples include improving math and science learning in local schools, training health practitioners for medically underserved communities and rural areas, and monitoring water quality in the state's rivers and estuaries. Faculty-initiated projects help small businesses improve their operations and assist industry in solving fundamental manufacturing problems. On a national and global scale, ECU research advances the frontiers of basic science in fields such as biochemistry, geology and pure mathematics, and contributes to historical and cultural scholarship.

SPILMAN BUILDING

Joyner Library, enlarged and renovated in a five-year, $30 million project, was dedicated in March as part of Founders Day activities. Its front porch is a unique sound, water, art, music, video and mist environment created by renowned artist Cristopher Janney and dubbed Sonic Plaza.

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