

ODYSSEY

• THE MAGAZINE OF UNIVERSITY OF KENTUCKY RESEARCH • WINTER/SPRING 1992 •



CLOSE-UP ON WOMEN IN SCIENCE



Jane Peters, Associate Professor of Art



Paul Willis, UK Director of Libraries



Erica McDonald, UK Student

“Behold a book. . . I will
nourish with it five
thousand souls, a hundred
thousand souls, a million
souls. . . all humanity. . .”

— Victor Hugo.

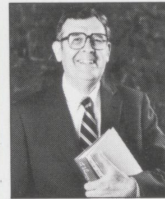
A Library for Kentuckians



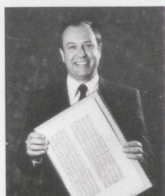
James E. "Ted" Bassett III, Chairman of the Board, Kentucky Association and President, Breeders' Cup



Paige Estes, UK Graduate Student



Lewis J. Swift, UK Dean of Undergraduate Studies



Charles T. Watkinson, Jr., UK President



Thomas D. Clark, UK Professor Emeritus

No building will be more important to Kentuckians than the new Commonwealth Library at the University of Kentucky. For in this library will be millions of books that in the words of Victor Hugo "will nourish." And the recipients of this intellectual nourishment will be thousands, even millions, of Kentuckians from all walks of life.

A new library will provide badly needed space for the University's excellent collection of over 2 million volumes and space for students to study and faculty to pursue their scholarly research. The economic impact of this state-of-the-art facility will be to move information quickly across the state — to doctors, lawyers, business people, farmers. To all book lovers it will be a coveted resource available no matter where they live, in small towns or large cities.

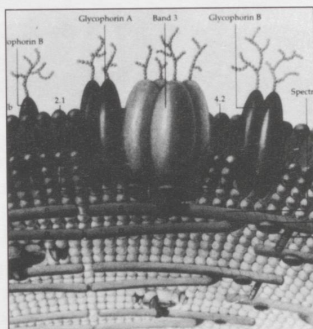
A campaign has begun. Its goal is to seek private funding to help build this new library, to match a challenge grant from the National Endowment for the Humanities, and to establish other endowments in support of the library. The generosity of private donors will get this historic undertaking started. State resources will see it through to completion.

That is our hope. That is our appeal to you. Support this new library at the University of Kentucky — this Library for Kentuckians.

UK Commonwealth
Library Campaign

For more information call (606) 257-7225
or call toll free 1-800-999-8635

ODYSSEY



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Close-Up on Women in Science

By Suzanne Froelich

- *Surprise, then discouragement greeted Deborah Powell's childhood announcement that she wanted to be a doctor. "My uncle, a surgeon, didn't think medicine was a good career for women," she says. "He didn't think women could work that many hours; he told me I should become a nurse."*

- *Ever since a doctor saved her life with an emergency appendectomy when she was five, Jacqueline Noonan has wanted to work in medicine. She was one of four women in a medical school class of 40, spent a decade of training without a single female mentor, and soon became accustomed to being the only woman in the room. "Medicine was then, and still is, a boys' network," she says.*

- *Miroslava Nikitovitch-Winer's interest in science always seemed natural, since her mother taught physics and she had aunts who were architects, chemical engineers and science teachers. When she moved from her native Yugoslavia to the U.S. in the early '50s and entered Harvard University's School of Medicine, she encountered a different view:*

"I remember one professor boasting there had not been any students from Wellesley at the medical school for the past several years," she recalls. "He said he had been told the Wellesley girls decided it wasn't really proper for women to go into medicine. Of course, these comments were very well received by the males in the class; the professor didn't care how I felt sitting there . . . But I never let things like that bother me. I knew I would go on regardless."



Deborah Powell

Powell, Noonan and Nikitovitch-Winer each went on regardless to become department chairs at the University of Kentucky College of Medicine, possibly making UK the only medical school in the country with three female department heads. Powell, who came to UK in 1976, has been chair of pathology since 1988. A member of the medical school faculty since its founding in 1960, Nikitovitch-Winer was named chair of anatomy and neurobiology in 1979. And Noonan, here since 1961, was named chair of pediatrics in 1974.

"All three of these individuals were promoted from the faculty into the chair positions," says Albert B. Chandler Medical Center Chancellor Peter Bosomworth, who, incidentally, served his internship in the mid '50s at the University of Cincinnati with Noonan as his supervising pediatrics resident. "Each is outstanding in her field and has gained national recognition for her personal accomplishments."

The medical center's distinction in having three women among its 29 directors and chairs, however, will end in 1992 when Noonan and Nikitovitch-Winer retire—Noonan to return to full-time teaching and Nikitovitch-Winer to take more time for family, hobbies, travel and other long-neglected personal interests. Bosomworth says identifying women candidates for top jobs is a priority and naming another female chair is "quite possible," especially in pediatrics, which has more women than other specialties.

Despite good intentions, the number of potential women chairs in medicine is small, says Powell, who heads the search committee reviewing candidates for Nikitovitch-Winer's position. "There are lots of women applicants for assistant professor jobs," she says, "but the pool is not great at the chair level."

Indeed, women may be entering science in record numbers—women now earn one-third of all graduate science degrees—but women are not rising through the ranks in proportionate numbers.

In academia, male Ph.D.s are more likely to hold full or associate professorships while females are more likely to be instructors, lecturers and adjunct faculty, according to a new report from the National Research Council.

At UK and other universities, the percentages of women earning doctorates in science are far

higher than the percentages of women professors on tenure tracks in these same fields.

And despite a doubling of women scientists in industry since 1977, women there remain underemployed and underpaid, the council report says.

Women scientists are paid less than male colleagues across the board. A 1989 National Science Foundation survey of 73,611 Ph.D. scientists in industry, academia and government found the salary paid women Ph.D.s was 20-25 percent less than that paid to men. Other studies have reported this gap continues throughout a scientist's career. (See chart on page 5.)

So it's hardly surprising women are rarities in the upper echelons of science. Of the 60 new members accepted last May into the prestigious National Academy of Science, only six were women. At the more than 120 major U.S. medical schools, there are four women chairs in anatomy and five in pathology; and in pediatrics—a field in which females will soon comprise 50 percent of practitioners—only seven. All told, three percent of medical school chairs are women, and surveys of other scientific fields, such as physics and engineering, reveal even smaller numbers of women at the top.

So why aren't women scientists climbing to the higher rungs of the professional ladder? Is there a conspiracy? Do they lack ambition? Or is it, as one male scientist suggested in a recent *New York Times* article, simply because "the men must be better than the women?"

"Men are not better than women," replies Powell, whose 37-member faculty is almost half women. "But until recently, men were better mentored and better encouraged for success than women were. Most women scientists have been mentored by men, and many men do not see women stepping into top administrative roles."

Powell takes her own role as mentor to the faculty, residents and interns in her department very seriously. "My responsibility is to provide an atmosphere in which they can compete successfully for national grants and get labs going, and to mentor them through the promotion process," she says, noting that all her researchers have obtained grants from the National Science Foundation or National Institutes of Health.

Studies have shown that women have more



Jacqueline Noonan

difficulty obtaining research grants, which is also due to inadequate mentoring, suggests Powell, who has done extensive research of her own on women's diseases. Women traditionally have not been as well trained as men, she says, in choosing the right collaborators, focusing on a single area, writing effective proposals, judging which committee appointments will best advance their career, and simply knowing whom to know.

"As more females move into key positions, young women will be mentored more appropriately," Powell says. A University of Michigan study found male researchers tend to work in groups of five or six, which means they all list that project on their vitae. Women, on the other hand, are more likely to work alone or with one other person. "Men play on teams; that is how they grew up. This is not so natural for women," observes Noonan, who has hired two basic researchers to assist the nearly 70 faculty, residents and interns in her department with research projects. The two happen to be female—a hopeful sign that times are changing, says Noonan.

A second reason for women's slow progress up the science ladder is the sometimes overwhelming demands of childbearing and child-rearing. In a fair world, spouses of professional women would share parenting 50-50, but stud-

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Miroslava Nikitovitch-Winer with Jim Hyde, assistant professor of anatomy and neurobiology

ies show this isn't happening.

In reality, women with science and engineering degrees are three times as likely as their male counterparts to be underemployed or unemployed, according to the National Research Council. In a survey of 1,500 male scientists and 2,700 female scientists, all unemployed and not seeking work, 40 percent of the women listed family responsibilities as the reason, compared with three percent of the men.

Powell and Nikitovitch-Winer, both mothers, say they had ideal situations—supportive husbands, lots of help at home, a relatively flexible employer—and yet balancing the demands of young children and science was “extremely stressful.” Nikitovitch-Winer has two children, ages 33 and 30, and Powell has four, ages 26, 24, 11 and nine.

Nikitovitch-Winer, married to UK biochemistry professor Alfred Winer, worked part-time when her children were very young, but never left before 2:30 p.m. when she was “half-time” or before 5 p.m. when she was “three-quarters time.” Had she truly worked half-time, it probably would have hurt her career, she says. “It would have been very hard to keep up.”

Even with her shortened schedule in the early 1960s, Nikitovitch-Winer managed to do a definitive study proving the brain controlled the pituitary, the master endocrine gland. During

this period, she also discovered a hormone made by the brain, called LHRh, which triggers the pituitary to release LH, a hormone that induces ovulation. This work gained worldwide attention and resulted in advances in fertility and other treatments used extensively today.

Women who balance the responsibility of young children with professional work that is compelling and important feel a terrible pull, says Nikitovitch-Winer. “Many women scientists say when they are at work they do not want to leave, and when they are at home with their kids, they do not want to leave,” she says, with the empathy of someone who has experienced these feelings.

And the stresses do not let up as children reach school-age, says Powell, who is married to Ralph Powell, chief of the pathology lab at the VA Medical Center. She tries to snatch time for her two younger boys from a work schedule that includes teaching, supervising a staff of 37 faculty, overseeing all the diagnostic pathology labs at the medical center, conducting research on ovarian cancer, and co-authoring a book on breast disease.

“I realize I am perhaps not giving my boys all I would like to of myself,” she says. “My job is so demanding. Sometimes I go home and think, ‘Oh not another slumber party! I can’t bear it.’”

Noonan, who never married, decided early in her career she never wanted to have to “choose between sick babies at the hospital and my own babies at home.” With children to rear, she might not have authored the 54 articles, contributed to the 26 books and other publications or presented the 53 abstracts listed on her curriculum vitae. And she might never have discovered the “Noonan Syndrome,” a multi-malformation condition in children that she identified in 1962 and has since lectured on in the U.S. and other countries.

“I chose to make medicine my priority, and I have no regrets,” she says. “Women today don’t necessarily have to make that choice, but they must set priorities and be realistic about compromises. Marriage and children may mean limiting your goals or putting your career on hold for a few years—and there is nothing wrong with that.”

“Not all people who go into medicine want to go to the top, yet for some reason, a lot of

people make women feel guilty if they are not being appointed chair or winning the Nobel Prize," Noonan says. "There is so much pressure. But what is wrong with doing two very important jobs—rearing a family and being an assistant professor of medicine?"

Noonan predicts that as women assume more leadership positions, scientific attitudes and schedules will become more "humane and flexible." She has set a precedent by letting pediatric residents work two months on, then one month off; this arrangement adds three months to each year of their residency, but accommodates family life. So far two residents, both mothers, have opted for it. Perhaps sometime soon, a young father will.

Although women still cope with the majority of child-care arrangements, parenting among two-career couples is gradually becoming a more 50-50 venture, observes Powell. "I see young women in science making family decisions with their husbands very much as a team, with the full understanding that both careers are important."

Part of any humane work environment is adequate day care, adds Nikitovitch-Winer. "The only way there will be total equality is if day care is taken care of. At UK we have a Kinder Care on campus with about 140 spots. That's not nearly enough. I think at UK and other academic institutions, every new building should have facilities for child care."

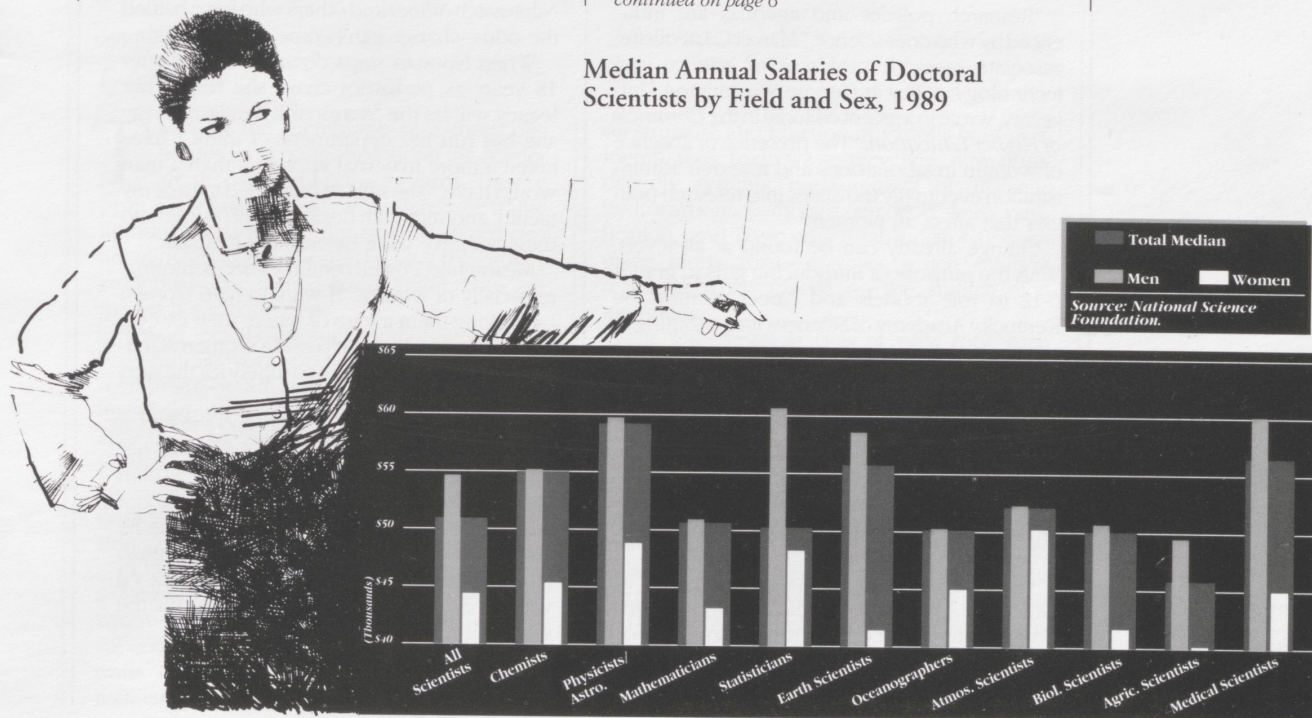
A third reason often cited for the small number of women in top scientific posts is bias against women as leaders.

Powell felt little bias early in her career, but the higher she rose, the more she has experienced, she says. "It has gotten progressively more difficult as I've gotten into more administrative areas—not the working part, but the working to be accepted. You are judged not simply on your abilities but because you are a woman. At times it is frustrating because you must waste time cutting through prejudice when there is so much else to do."

Still, Noonan, Powell and Nikitovitch-Winer agree the climate for women scientists is dramatically better than it was when they started

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Median Annual Salaries of Doctoral Scientists by Field and Sex, 1989



out, and they believe it will continue to improve as more women enter scientific fields and workplaces.

"I have been on national committees where women were well represented and listened to, and I have been on other committees where this is not the case," says Powell. "The point is, it [bias] is becoming a very individual thing now.

"It will get easier for women," she predicts. "I am very optimistic about that because, as there are more women to interact with and serve as mentors in science, young men coming up will be more comfortable with and sensitive to women in equal or superior roles."

More women leaders in science will not only change the work environment but the directions and scope of research. After it was revealed before Congress last June that women were routinely excluded as subjects in federally sponsored biomedical research—leaving breast cancer and other female diseases inadequately studied—public outrage led to greater focus on women as subjects as well as to a new awareness of why more women should be involved in science.

"Research policies and agendas are influenced by who does science," Marcel C. LaFollette, associate research professor of science and technology policy at George Washington University, wrote in a recent editorial in the *Chronicle of Higher Education*. "The presence or absence of women in laboratories and research administration eventually translates into research policies that affect all women."

Change already can be found at all levels. With the purpose of introducing girls in grades 6-12 to role models and career mentors, the Kentucky Academy of Sciences is distributing to science and math teachers a directory of women established in science careers. These mentors have agreed to advise individual students, help with science projects and speak before classes.

On a national level, in a 1990 report on improving the climate for women in medical schools and teaching hospitals, the Association of American Colleges singled out these model programs:

- At Yale University School of Medicine, an Office for Women in Medicine supports and promotes female doctors through forums, informal faculty-student lunches, a counseling and

referral service, a newsletter, lectures, regional conferences and an annual report on the number of faculty by rank and gender.

- University of California faculty members who take childbearing or parenting leaves of up to one year receive full pay (the same as sick leave and sabbaticals) and may "stop the tenure clock" by having that time excluded from the probationary tenure period.

- Since the Association of American Medical Colleges created the position of Women Liaison Officer in 1976, all U.S. medical schools, one-third of academic societies and one-quarter of teaching hospitals belonging to the association have appointed one. This person initiates programs for women, serves as a resource for the school on matters involving women, and promotes recruitment and advancement of women.

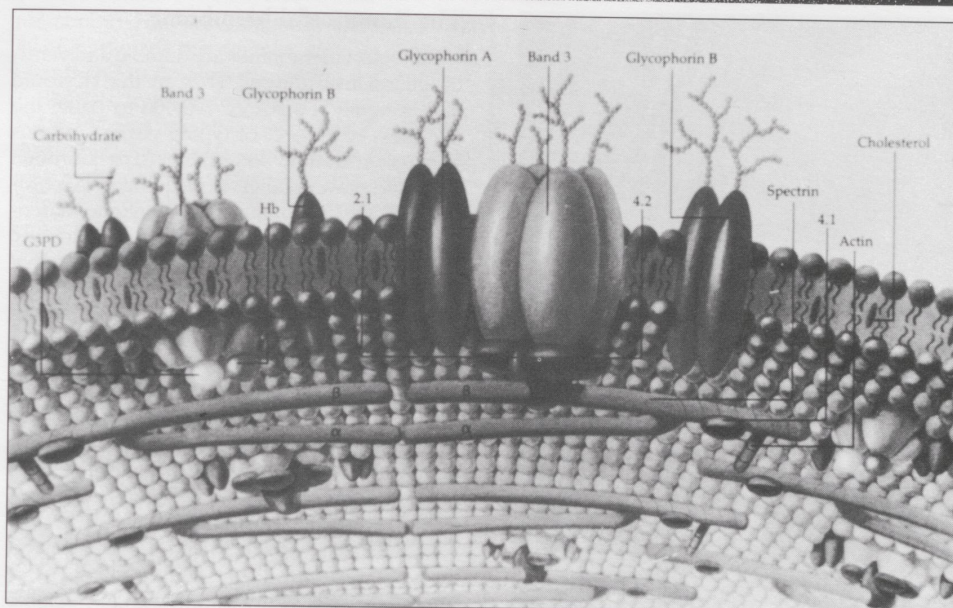
The Bureau of Labor Statistics tells us jobs in science and engineering will increase 36 percent by the year 2000. So instituting changes that help women assume a fuller role in science will not simply be a question of fairness but of necessity. For Noonan, Powell, Nikitovitch-Winer and others who have battled the odds, change can't come soon enough.

When Noonan steps down next year after 18 years as pediatrics chair, she hopes her legacy will be the "reasonably feminine" way she has run her department. "I think I have taken a more maternal approach than a man would have," she says. "I have tried to treat my faculty and staff with flexibility and fairness so they can have a life outside the hospital."

Meanwhile, Powell continues her mentoring, especially of women. "I want to help women by making them aware of where their careers are going. I want to help bring women scientists along so it will not be so lonely for the next generation."

Nikitovitch-Winer recalls a friend she had at Duke Medical School, where she received her Ph.D in the late '50s: "He was a wonderful man from the South who was very unhappy about blacks wanting total equality. He told me he couldn't understand why they wanted it all to happen tomorrow. I said if I were black I'd want it all to happen tomorrow too. It's the same with women in science now." ♦

Penetrating the Mysteries of the Mighty Membrane



Drawing of a biological membrane showing various proteins inserted in, on, or through it. These proteins perform specific biological functions for the cell membrane.

by Jeff Worley

Think of the membrane as a metabolic border. And positioned along the border are thousands of border guards. They're pros. They know exactly how to handle traffic approaching from any direction. Some vehicles are allowed to pass; some, lacking the proper credentials, are turned back. Membranes are the body's gatekeepers.

Where, exactly, are such membranes found? For starters, your body is covered with a membrane—your skin. Human kidneys and eyes have membranes. And modeled in part after these biological membranes are various synthetic membranes that make our lives more convenient, safer. Household plastic wrap, drinking water purifiers, new types of pharmaceuticals, orange juice processing plants.

In UK's Center of Membrane Sciences, over a dozen research projects are currently underway to unlock the mechanisms of both biological and synthetic membranes. Sixteen faculty from 10 departments and six colleges are teamed up on various projects, including work

on structure and function of various biological membranes, toxic waste recycling, new drug-delivery systems, measurement of aromatic hydrocarbons, pathogen detection, water purification, and basic structural/functional work using bioreactors—enzymes which catalyze reactions when placed on the surface of a membrane.

The UK center is one of only four such academically based centers in the United States. "William Koros at the University of Texas and Sun-Tak Hwang at the University of Cincinnati are working on gas separation through synthetic membranes," says UK center director Allan Butterfield, "and Israel Cabasso at Syracuse University is working on the production and characterization of synthetic membranes." Butterfield speaks highly of these researchers and their work, adding that the primary difference between their approach and that of the membrane center at UK is the focus here on integrating biological and synthetic membrane research.

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Allan Butterfield, director of the Center of Membrane Sciences, examines the sample cavity between the two poles of the large electromagnet used in conjunction with an electron spin resonance spectrometer. This equipment is used to investigate membrane structure and function.

"Most of the other centers in the U.S. are composed of people in one department, chemical engineering, for example," Butterfield explains. "One of the things that makes our center unique is the strong interaction between experts in biological membranes and experts in synthetic membranes," he says. "In our program researchers in both fields work together with the goal of trying to understand each other's perspectives to develop new systems that embody the properties of both."

The Resourceful Membrane

Biological membranes are durable and versatile guardians of the cell. They are thin (it would take roughly a stack of 200,000 to equal the thickness of a sheet of typing paper), porous barriers which allow some things to pass through them and prevent others from doing so. According to Butterfield, membranes separate materials not only based on the size of the particles, but also based on chemical interactions that take place between molecules trying to pass through the membrane and molecules within the membrane itself.

"Membranes do filter substances," says Butterfield, "but unlike ordinary filters, coffee filters, for example, membranes rely on chemical interactions which allow or prevent molecules to pass through." Membranes, he says, can in this way "filter out" a substance even if it is smaller than the pore size.

Three distinct regions make up a biological membrane—the outside region, a bilayer of lipids (greasy substances only partially soluble in water), and an underlying cytoskeleton. The membrane bilayer consists of two layers of lipids, each layer one molecule thick. The bilayer contains proteins which perform specific biological functions for the membrane. These proteins are either embedded into or loosely attached to the membrane lipids. Because they like water, the heads of the lipids face toward either the outer watery region or toward the watery cytoplasm inside the cell. The rest of the lipid structure, long hydrocarbon tails, face inward and form the center of the membrane.

The cytoskeletal framework, Butterfield says, is a network of crisscrossing interconnecting proteins that laminate the inner side of the cell membrane that faces the interior of the cell. He demonstrates: "If you take the fingers of your two hands and interlace them at 90 degrees, little holes are formed. This is similar to how the cytoskeletal network appears under scanning electron microscopy."

Developing Synthetic Membranes

The various properties of membranes, according to D.B. Bhattacharyya, UK professor of chemical engineering working with the membrane center, enable scientists to do amazing things. "If the selective properties of biological

membranes can be combined with the durability of man-made membranes, you can design a membrane to do almost anything you like."

Bhattacharyya, assisted by graduate students Mike Williams and Myeongjin Han, is currently developing synthetic membranes at UK which may in the near future have commercial applications in desalination and in removing and condensing toxic waste. "We're now using composite synthetic membranes made of polyamides," Bhattacharyya says. "These are an improvement over earlier membranes used to separate seawater because less pressure is needed to get more clean water through the system than when cellulose acetate was used in the '60s." The membranes used by Bhattacharyya and his graduate students leave the desalinated water 99.99 percent free of salt. (Seawater contains approximately 3 1/2 percent salt.)

In a lab on the seventh floor of Anderson Hall, Han demonstrates how he makes a membrane that could be used to purify seawater. On a flat glass plate he pours a murky solution, which he then spreads evenly on the plate with a glass rod. He lets the solution evaporate for a few minutes, explaining that "the longer you let it set, the smaller the membrane's pores will be."

Han then submerges the plate, with the solution now affixed, into a water bath. He leaves the plate in the water for 10 minutes. Then he takes the plate out and simply peels the white membrane off. The membrane, translucent but not transparent, feels a bit like Saran Wrap with an extremely thin plastic coat attached.

"It looks simple," he says, "but it's really a delicate process. The smallest change I make in any step—the proportion of chemicals, the temperature of the water, the length of time it stays in the bath—can make a huge difference in the final product." Han further explains that such membranes are packaged in spiral-wound or hollow-fiber configurations in the seawater separation process. "The membranes actually used by industry look like tight clumps of cooked spaghetti."

Synthetic Membrane Use

It's clear that such refinements in polyamide and other composite membranes could have far-reaching consequences. Membranes are used routinely, for example, in the desalination process. According to Robert L. Riley of Separation Systems International, there were 6,250 desalting plants operating worldwide in 1988, with a total capacity of three billion gallons per day. He

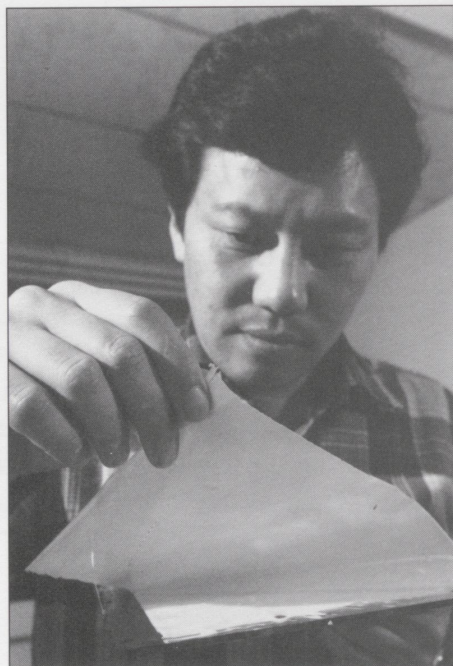
In years to come, it may be possible for industry to use these membranes to carry out all kinds of basic processes, from improving the taste and longevity of certain foods to getting rid of environmental hazards.

estimates that in the U.S. there are about 750 desalting plants with individual capacities of more than 25,000 gallons per day.

The same type of spiral-wound membrane that separates salt from seawater can be used, Bhattacharyya says, to remove toxins from water. He explains that a significant area now for membranes is material recovery and water reuse in factories. "There are in Lexington, for example, several plating companies that use cadmium plating. In the plating process, a lot of fresh water is used to rinse the plating components, and that water picks up small amounts of nickel, cadmium, chromium and zinc. The procedure now is that the resulting sludge is put in drums which are sealed and taken to hazardous waste sites—these valuable metals are simply tossed away."

Bhattacharyya says that a membrane-driven process would not only allow the water to be purified for reuse, it would also recover the metals for reuse. "The same membrane that separates salt from seawater can be used to remove these toxic metals. The membrane lets the water pass through, but not the plating components. They become concentrated around the membrane and can be put back in the plating vat." An additional benefit is that no

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Myeongjin Han, a native of Seoul, Korea, peels a synthetic membrane off a glass plate. Such membranes, when packaged in spiral-wound or hollow-fiber configurations, are used to separate salt from seawater.

toxic materials would have to be disposed of. Bhattacharyya says that every year chemical manufacturers generate millions of tons of wastes containing various hazardous pollutants, and membrane technology provides a partial solution to this problem.

With funding from the Department of Energy for the past four years, Bhattacharyya has been working on another project which may make for a cleaner environment—sulfur removal from coal. This project began with the serendipitous discovery of bacteria that thrive at high temperatures. "They exist in hot springs or deep in the ocean—they're real happy there," says Butterfield. "And their energy source is sulfur."

"They eat sulfur like some people might go

through a box of donuts," adds Bhattacharyya, who has teamed up with UK biologist Hussain Aleem on this project. "Bacteria are nothing more than a live entity inside a membrane," Bhattacharyya says, "and if they don't consume enough sulfur they die." He explains that a slurry of coal put in the presence of this bacterium will literally have the sulfur chewed out of it, thus making the coal cleaner and safer to burn. "You can burn the coal without polluting," Butterfield says, "without creating acid rain."

Another member of the membrane sciences group, Leonidas Bachas, is also doing work that may lead to a cleaner, safer environment. Bachas, an associate professor of chemistry, is currently involved in a project focused on groundwater pollution.

"I've been interested for some time in what are called 'membrane-based sensors,'" Bachas says, "which can detect how much herbicide and nitrate end up in well water and groundwater." He explains that to monitor the pollution of groundwater a small hole could be drilled into the ground and a fiber optic sent down to the water level. The tip of the fiber would have a membrane attached. The membrane would be chemically treated so that herbicide and nitrate levels could be detected; a signal in the form of light sent through the fiber optic could then be measured by equipment in a nearby or even distant location.

"One clear advantage of doing remote sensing using fiber optics is that fiber optics will not pick up any of the electrical noise that wires pick up," Bachas says. "With metallic wire you get an increased noise level." Bachas imagines a time in the not-too-distant future when such a fiber optics system will be hooked up to a computer in a farmhouse, enabling the farmer to determine at any time the level of chemicals in his groundwater. The first step in controlling the pollution due to the amount of herbicide and nitrate fertilizer used in farming, Bachas points out, is to get an accurate measurement of how much is getting into the groundwater supply.

Another recent development by the UK group should also be of interest to Kentucky farmers—a time-release pesticide. According to Bhattacharyya, with this system the chemical is contained in millions of tiny membrane

spheres, which can be scattered over crops as regular pesticide is. But the membrane pellets release the pesticide slowly and evenly, instead of dumping a sudden concentration of poison which may be washed off quickly and therefore be less effective, Bhattacharyya says.

Butterfield compares this approach to the coatings of drugs such as aspirin. "Most aspirin these days has a little polymer coating around it so that it doesn't dissolve in your stomach so fast—it gets into the intestine before it starts to fully dissolve. With these agricultural chemicals such a polymer will be degraded slowly. The molecules will gradually leach out through the interstitial spaces of the polymer, which must be made of course so that it isn't immediately soluble in water."

Some of these new potential uses for membranes attracted the attention of Michael Jay, an associate professor of pharmacy at UK. "I got involved in the center about six years ago as a result of some work I was doing with Allan," Jay says. "The more I learned about synthetic membranes, the more interested I became in their application to the area of radiopharmaceuticals." Radiopharmaceuticals spontaneously emit radiation and are used diagnostically or therapeutically.

Jay is currently using synthetic membranes as a solid physical support for enzymes which are used to catalyze the synthesis of short-lived radiopharmaceuticals. Because they ultimately emit gamma rays, they can be monitored on an image display screen.

"We're trying to make radiopharmaceuticals that have a very short half-life," Jay says. (A half-life is the time required for the radioactivity to decay to one half of its initial level.) "So we're interested in making those reactions go as fast as possible." He says that the membrane in such tests is being used in two ways: it serves as a solid support for the chemically bound enzyme and it allows only the desired product to pass through it.

Intensifying Biological Membrane Research

Butterfield, in addition to coordinating the various activities of the research group, has recently been doing basic research to better understand the structure of the cell membrane and how the structure relates to its function. "In

particular," Butterfield says, "we ask questions such as how modifying one side of the membrane will affect the physical state of the other side." By more clearly understanding biological molecules, Butterfield says researchers can design synthetic membranes which have specific biological properties and functions.

"What we want to do is develop a fundamental set of rules, chemical principles, that will point toward the best conditions for generating a particular type of biofunctional membrane. In years to come, it may be possible for industry to use these membranes to carry out all kinds of basic processes, from improving the taste and longevity of certain foods to getting rid of environmental hazards," says Butterfield.

In investing such a considerable amount of time and energy to the membrane work going on at UK, how has Butterfield benefited?

"Each of my colleagues brings a different way of looking at membrane systems, from which I gain knowledge. I think the greatest aspect of this whole Center of Membrane Sciences is being able to watch what happens when two people with vastly different backgrounds, approaches and techniques get together and learn from each other, to see something fruitful come from that. And we've had this happen time and time again within the center."

Bachas agrees. "We enjoy research, of course, because there's always the possibility of finding something new, something that will benefit people. But it's also terrific to be working with graduate students, watching them become independent researchers—educating and being educated by them," he adds.

And what of the future of this relatively young science?

"It seems to me," Butterfield says, "that the whole area of membrane research, both biological and synthetic and especially the interface of the two, is limited only by the imagination of the people working with it. And we're fortunate to have some very imaginative people working together here." ♦

Bravo!

Stellar Students Choose UK

Angelina Alvarado, who took an undergraduate degree from Bowling Green State University, has completed two years of graduate



work in the Multidisciplinary Ph.D. Program in Nutritional Science. She is presently conducting research in the area of nutrition and atherosclerosis, using cultured vascular endothelial cells to study the effects of lipids and vitamins on endothelial cell function. Alvarado has presented the results of her research at several scientific meetings. Her many awards include a Graduate School Minority Fellowship for the 1989/90 academic year, the Lyman T. Johnson Fellowship for the 1990/91 academic year, and the Abby L. Marlett Scholarship, given each year to the outstanding graduate student in the Department of Nutrition and Food Science.

Warwick Arden left a tenure-track faculty position at Michigan State University's College of Veterinary Medicine to pursue the Ph.D. degree in cardiovascular physiology here at UK. Dr. Arden earned the B.V.Sc. and the D.V.C.S. (veterinary) degrees from the University of Sydney (Australia), the M.S. degree from Michigan State University, and is board-certified in veterinary surgery. Arden is doing research in the cardiothoracic surgery research labs on the effects of certain neuropeptides on the coronary circulation during septic (the toxic spread of bacteria) shock.

Jonathan Edwards, a native of Lexington, is pursuing a Ph.D. in computer science. Jonathan did his undergraduate work at Brown University, where he accumulated a 3.96 GPA.



He is being supported this year by a Presidential Fellowship, which includes full tuition and \$9,000 living expenses. In his studies, Edwards wants to specialize in "systems architecture" or in "operating systems." After earning his doctorate, he wants to teach at a small college in the Lexington area.

Holly Everett, a Louisville resident, served as president of student government while an undergraduate at the University of Louisville. As part of her duties, she oversaw a budget of a



third of a million dollars and a staff of 12. Everett was also chosen by the president of the University of Louisville to chair the advisory committee recommending to him the allocation of proceeds from the Fiesta Bowl. Everett, who maintained a 3.7 GPA, was named

outstanding senior in the College of Arts and Sciences and received the Eleanor O'Sullivan Award for Outstanding Senior Woman in Political Science.

Melinda Hoffman comes to UK from Ohio State University, where she completed both an undergraduate degree and a master's of science degree, compiling a 3.8 GPA for both. She is now enrolled in crop and soil sciences, focusing on legume cover crops with weed suppressive activity. Melinda plans to develop a broad collection of hairy vetch germplasm and develop various isozyme marker systems to differentiate among germplasm. Hoffman is the recipient of a University of Kentucky Fellowship for Women in Underrepresented Areas.

Terri Miller entered UK's Ph.D. program in clinical psychology in 1989. In that year, she was awarded a Lyman T. Johnson Fellowship. In 1990 Miller was selected to be a Ford



Foundation Minority Fellow, one of the most prestigious fellowships for minority students in the country. She is currently completing her M.A. thesis, titled "Perceived and Self-Reported Parental Drinking Behavior as Determinants of Children's Alcohol Expectancies."

Miller has worked as a graduate clinical trainee at Charter Ridge Hospital for the past year.

Suzanne Numan came to UK's anatomy and neurobiology program as a result of her interest in the neurobiology of aging. Numan's family, it seems, has neuroscience in their genes:



Her father and her uncle are physiological psychologists in academic positions, her mother collaborates and publishes with her father, and Suzanne's sister is in a clinical neuropsychology training program.

Numan, a Phi Beta Kappa graduate of the University of Massachusetts at Amherst, began her doctoral work this past fall.

Jeremy Prepisci is pursuing a master's degree in the Patterson School of Diplomacy and International Commerce. Jeremy's strong



record as an undergraduate won him a Patterson Fellowship and a UK Graduate School "Quality Achievement" Fellowship award. Prepisci, who began his graduate studies this past fall, is a member of the political science honor society, Pi Sigma Alpha, and the Golden Key National Honor Society.

Evelyn Tackett brings a wealth of practical experience to her work as a graduate student in health administration.



As a teenager, she lived for four years in Europe and attended the International School of Rome for one year. After earning a B.A. in psychology from Wright State in 1968, she moved to Hazard, Kentucky and managed a computerized information system for a

beverage distributor for seven years. With a special interest now in mental health and hospice care, she is taking courses that will enable her to return to Hazard to help solve health-care problems in that community. Tackett, whose daughter is a freshman at UK, is also a graduate assistant in the College of Allied Health.

Mark Thompson is soon to be the first graduate of UK's Master's in Health Administration program. He is currently meeting the residency requirement for the degree by working as a resident at Edinburg Hospital in southwest Texas. Because of Edinburg's small administrative staff, Thompson deals with the major problems confronting the health-care industry (such as patients who are under-insured or have no insurance), according to Jim Suver, Thompson's advisor in the program.

Jill Uhl received her B.S. degree in biology from UK in August of 1991. With a 3.7 undergraduate GPA, she graduated with Honors and



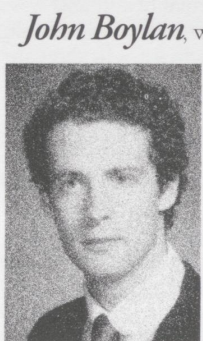
High Distinction. As a Gaines Scholar, her degree requirements included the writing of an undergraduate thesis, titled "Mears Island, a Puzzle of Perspectives." This investigative work, according to her advisor S.K. Chan, "prepares her well for graduate work."

continued on page 14

Premier Placements



Karin Bennett, a 1991 Ph.D. graduate in mathematics, received a postdoctoral fellowship to research the parallel implementation of computational algorithms at the University of Minnesota's Institute for Mathematics and Its Applications, one of the most prestigious institutions of its kind in the country. Bennett was supported by the Center for Computational Sciences during the past four years.



John Boylan, who received his Ph.D. in microbiology in 1989, is now a postdoctoral fellow in the Department of Pharmacology at Cornell University Medical College. Before that, he was a postdoctoral fellow at Harvard Medical School's Dana-Farber Cancer Institute, where he won the Richard A. Smith Award after his first year for conducting the most outstanding research by fellows at the center.



Susan Campbell became an assistant professor of chemistry at Centre College in Kentucky soon after receiving her doctorate in biochemistry this past July. She currently teaches chemistry to both first-year and upper-class students. "I think Susan is headed for certain success at Centre," says S.K. Chan, one of Campbell's biochemistry professors at UK.



Lori Jones has made "several important contributions to our understanding of the immune system, particularly development of the T-cell repertoire and immune tolerance" since earning her Ph.D. in microbiology in 1988, says Alan Kaplan, chair of microbiology and immunology at UK. Jones is now a postdoctoral fellow at the National Institutes of Health and has published 10 papers with her advisor there, Ada Kruisbeek. "NIH is the best biologic research institute in the world, and Lori's acceptance in Ada Kruisbeek's laboratory was a great honor," says Kaplan.

Bravo!

Janet Neisewander has been appointed assistant professor of psychology at Arizona State University, where she is working on research of neurochemical models of drug abuse and psychopathology. After receiving her Ph.D. in experimental psychology in 1988, she worked as a research associate in the Department of Pharmacology at the University of Pennsylvania, one of the leading pharmacology departments in the country. For her work at Penn, she received an individual postdoctoral research fellowship from the National Institute on Drug Abuse.



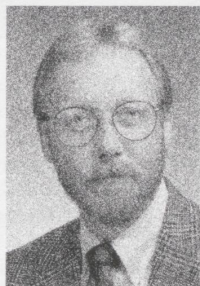
Prasad Pai, who received a doctorate in chemical engineering in 1991, has been named a computational scientist for the California-based ENSR Consulting and Engineering Company, an industry leader on environmental issues. The appointment stemmed from Pai's dissertation work on the computer modeling of atmospheric pollution. Pai was supported by the Center for Computational Sciences during the past four years.



Donna Palmieri earned her Ph.D. in chemistry from UK in 1989. She then worked in a postdoctoral position at Penn State for two years before accepting a position at Boehringer-Mannheim, a pharmaceutical and biotechnology company. Palmieri was offered the position on the basis of her work at UK as well as 11 publications based on her Ph.D. dissertation, according to Allan Butterfield, Palmieri's advisor. "Boehringer-Mannheim hires only the top graduates," says Butterfield. "I see Donna serving as a role model for excellence in chemistry and membrane sciences for all chemists, but for women chemists in particular."

Susan Fisher Thomas, a 1978 Ph.D. graduate in anatomy and neurobiology, is now professor and chair of anatomy and embryology at the UC San Francisco College of Dentistry. "She has an outstanding record in research and teaching," says Stephen D. Smith, her advisor at UK, "and is now compiling an equally outstanding record in administration. In a remarkably short time she has very rapidly progressed up a highly competitive ladder."

Thomas Wood, a 1990 Ph.D. graduate of UK's Graduate Center for Toxicology, has begun his duties as director of scientific consultations and as liaison officer for Harris Laboratories in Phoenix, Arizona. In addition to functioning as the scientific liaison and consultant for all of Harris' clients, Wood will serve as consultant to the equine and canine racing communities. Wood will also serve as the Laboratories' expert witness in litigation proceedings. ♦



HONORABLE MENTION

Chemistry Graduate in Her Element at Canadian University



Mary Frances Richardson explains the principles of X-ray diffraction to Brock University students.

Mary Frances Richardson's love of science goes back to 1951, the year she saw the science-fiction classic "When Worlds Collide" at age 10. Watching scientists expand the horizons of the known world in that darkened movie house in Barbourville, Kentucky thrilled her in a way that was not to fade after the walk home.

"I started building rockets in the backyard the next day," says Richardson, who went on to earn her B.S. and Ph.D. degrees in chemistry from UK. "There is such a sense of adventure in science."

In the 40 years since then, Richardson

has built an impressive career based on her two loves—scientific research and teaching. Her ground-breaking research into the structure of molecules has gained attention from scientific groups around the world, and her effectiveness in the classroom led to two major teaching awards in 1991.

She discovered her love of teaching while a graduate student at UK. "I find it thrilling to be able to help people learn things they want to know about," she says. "But I like research equally well and would certainly feel I were missing something if I could not do research. I would not want to give up either."

Richardson, a professor of chemistry

at Brock University in Ontario, in 1991 received a Teaching Award from the Ontario Confederation of University Faculty Associations, which annually bestows this prestigious award on seven teachers chosen from 12,000 faculty members in the province. She also was "very touched" in 1991 when she received a Brock Alumni Association Award for Excellence in Teaching.

Richardson has been praised as a warm and compassionate teacher who truly cares about her students. Several years ago she had a student who wanted to major in chemistry but was unable to reach all the lab equipment because he was in a wheelchair. Richardson ob-

HONORABLE MENTION

tained grant money and, with two other faculty members, worked with the university machine shop to devise an adjustable-height wheelchair. Since then, two similar wheelchairs have been made for other handicapped students, and the original student graduated with his chemistry degree.

As a researcher, Richardson has published more than 50 papers and is well known in chemistry circles around the world, especially for her study, published in the late '70s, on the gas/solid asymmetric transformation inside a centrosymmetric crystal. "Mary is an original thinker and has a deep understanding of crystal chirality," says Meir Lahav, a chemist at the Weizmann Institute for Science in Israel, the leading organic solid-state chemistry research group in the world. "I am also most impressed by her ability as a teacher."

Chirality refers to whether molecules can be superimposed on their mirror images, similar to how left- and right-handed gloves fit together. Richardson demonstrated in her study that it is possible to turn a molecule with two-dimensional chirality into a molecule with three-dimensional chirality—a feat previously thought not possible. Such broadened knowledge of molecular structures, says Richardson, may lead to the development of new materials for possible use in the pharmaceutical and biochemical industries.

When Richardson looks back on her UK days, she is especially grateful to chemistry professor Bill Wagner (now retired) for showing her that chemistry was "wonderful stuff" and for never

discouraging her because she was a woman. "There were lots of people telling me I'd never get a job in chemistry, but he never treated me differently from the male students."

Richardson takes pride in having proven those early nay-sayers wrong, but hers has been a somewhat lonely climb in an almost exclusively male sphere. As a UK undergrad, she was the only female chemistry major in her class. She is the only female full professor in her department, and when she served as department chair at Brock in 1979-1981, she was the only woman chemistry chair in Canada. Presently, about 20 percent of chemistry Ph.Ds in Canada are women.

During her 20 years at Brock, Richardson has taken a very active role in committee work; this was a deliberate effort to be a role model, she says. "Women need to be better represented at the power levels of universities. As my career progressed and I was asked to sit on major committees, I did it. I felt if I did well, people might say, 'Hey, we should get another woman on some time.'"

"Being the 'only woman' on this and that has been a burden," she says. "I have been doing it a long time, and now that there are younger women coming along, I'd like to have more time for the things I really like—research and teaching."

In 1979-1981, Richardson was the only woman chemistry chair in Canada.

Richardson is currently studying the crystallization of silicon carbide, a very hard substance used as a diamond substitute. "Silicon carbide crystallizes in many different forms, called polytypes, which are not well understood. I am interested in the whole area of why some substances crystallize as polytypes and others don't, and the effect of these polytype structures on the physical and chemical properties of crystals."

After 30 years of research, she still clearly enjoys wrestling secrets from this submicroscopic world of atoms and molecules. "Much of what I study is so small I cannot see it with a standard microscope—I use an X-ray diffractometer—but it is still an exploration of the world," she says. "It's not anything like 'When Worlds Collide,' but it still thrills me." ♦

—Suzanne Froelich

BEHIND THE SCENES

Bibliographies, Black Gold and "Buckyballs"

by Elizabeth Hansen



Theresa Wiley

When Frank Derbyshire or any of his colleagues at UK's Center for Applied Energy Research want some detective work done, they know who to call. Theresa Kelty Wiley, CAER librarian, routinely hunts down obscure manuscripts and elusive citations—and the more challenging the task, the more Wiley likes it.

When she was hired as coal bibliographer for UK's Institute for Mining and Minerals Research in 1972, Wiley already had a master's degree in library science, but the only thing she knew about coal was that it was "that dark, lumpy stuff that used to be down in the basement of my grandparents' home."

So Wiley set about educating herself. "When I first got the job, I used to go home at night and I'd read coal newsletters until I was just about ready to fall asleep, just to find out something about coal."

Nineteen years later that same initiative and enterprise earn Wiley praise for her work as library manager at UK's Center for Applied Energy Research (CAER) on Iron Works Pike just outside of Lexington. The special library houses about 5,000 books and 40,000 microfiche reports on coal, oil shale, and energy, along with scientific and technical journals.

"She really is quite outstanding," says Derbyshire, director of CAER. "I find her very enterprising. She's the only person, to my knowledge, not in a research area (at CAER) who has managed to put in a proposal and have it funded." The two-year grant from the Kentucky Department for Libraries and Archives is funding conversion of the library's card catalog to a computer-readable format so that library holdings can be accessed through an on-line cataloguing system.

Wiley still wouldn't claim to be an expert on coal, but she has picked up enough knowledge "by osmosis" over

BEHIND THE SCENES

the years to be able to "wade through" much of the material the library handles.

Wiley describes her job in one word: service. Her job is to help the center's researchers do their work. "I'm not here to do research myself. I'm here to try to cut corners for them so that they can spend all their time doing research, not trying to track down obscure articles or finding out how many papers so-and-so wrote in the last 10 years," she says. Wiley has been asked to track down such things as French journals from the early 1800s and information on World War II-era spies and spy networks from early socialist magazines.

Derbyshire once asked her to conduct a literature search on the term "Buckyballs," Wiley recalls. "It just caught my funny bone when he came in and said 'Buckyballs.' It didn't sound scientific at all. I thought it was going to be another of these way-out searches," she says, drumming her fingers on the table in front of her as she often does as she talks. She quickly learned that "Buckyballs" is scientific slang for Buckminsterfullerenes, a spherical carbon that resembles Buckminster Fuller's geodesic dome design and is a hot topic among researchers.

Now as Wiley scans new journals coming into the library for topics of interest to CAER researchers, "Buckyballs" is one topic she looks for. When she finds new literature related to the 20 or so projects under way at the center, she alerts the appropriate researchers.

Wiley's work revolves around the research. She helps identify external funding sources and conducts literature searches. Much of the work—particularly work for grant proposal—is done under deadline pressure.

Two years ago Wiley learned about grant proposal writing first-hand. Because of interruptions, she found it difficult to write the proposal either at work or at home on the farm 12 miles north of Georgetown where she lives with her husband, Robert, a farmer and school bus driver, and their four chil-

dren, Robert Jr., 17, Elizabeth, 15, James, 7, and Ruthie, 3. So after work Wiley sometimes went to a restaurant in Georgetown to write.

"I would get myself a salad so I could slowly eat for hours, and I would sit there for two or three hours at night and write this grant proposal. Sometimes I'd be there til 10 o'clock. I could concentrate. Nobody would bother me," she says.

Writing the grant proposal was an educational experience, Wiley says. "Even if I never do it again, I feel like I can really empathize more with the researchers when they are [writing grants] because I've actually had to do that myself."

Wiley's proposal writing resulted in a two-year grant from the Kentucky Department of Libraries and Archives to convert all CAER library catalog records to computer format. This change will allow libraries all over the country to access the library's collection via computer. In the past, the library received few requests from outside the CAER for information "because our records haven't been on-line. Nobody knew what we had unless they came here," Wiley says. By the time funding from the grant ends this summer, 4,600 to 4,700 of the library's titles will be on-line.

After receiving her MSLS degree from UK in 1972, Wiley worked for a summer at the Special Services Library at Fort Knox. Then she took a one-year job as a coal bibliographer with the UK Institute for Mining and Minerals Research (IMMR). The institute had no library of its own; she served as a liaison between the institute staff and the campus libraries—"a glorified gofer, when you get right down to it," she says. The one-year job became a permanent position and in 1974 she got her first budget to buy books for an institute library.

When IMMR was contracted by the state to manage the new Kentucky Center for Energy Research, which opened in 1977, Wiley became library manager. Then in 1982, the state merged the KCER library with the Kentucky Department of Energy located in an adjacent building on the Iron Works Pike property. Wiley supervised the move of the IMMR collection she had built to the KDOE building and was manager of the combined library until 1988. Wiley then moved the library to its present location just inside CAER's main entrance.

Like her father who worked at the same job all his life, Wiley is content to stay in the same job indefinitely. "It's turned into a lifetime job so far, keep my fingers crossed," she said, rapping the table. "I'm the type of person, I guess it's the way I grew up, I'm very happy staying in one place. I like the security." Wiley also loves the freedom and opportunities for professional growth her job offers, and she feels her decisions have an impact.

"I feel like somebody notices if I make a decision that helps the lab. I have a real feeling of camaraderie with the other people here. I feel like I'm part of the team, like we're all working together to achieve the same goals. And it's really nice." ♦

Cultivating our Rural Past

Their questions digging up the rich terrain of our rural past, seven graduate students this summer interviewed 120 people who have made a living at some point in their lives on a family farm in Kentucky.

How did farmers in the past market tobacco? What did families eat? How did the male-female division of labor work? What role did black farmers have? How did changes in family structure and crops affect farm lay-out?

The ideas, practices, mistakes and successes of the past harvested from these oral histories will be studied in a joint long-term research project of the Center for Developmental Change, the Oral History Program and several academic departments.

"Until recently in Kentucky and many other states, the majority of the population has been involved in farming," says Thomas Arcury, the CDC's associate director for program development and an adjunct associate professor of anthropology. "We need to discuss how it was, how it has changed, and the effects these changes are having today on people and the economy."

With \$78,000 in grants from the Kentucky Oral History Commission, the project began last January with a series of planning seminars involving a dozen faculty members from history, sociology, anthropology, behavioral science and English.

The summer interviews focused on class formation and gender roles, nutrition and food customs, and tobacco growing and marketing. Additional interviews this fall centered on black farm families, family organization, farm spatial structure and non-agricultural activities on farms.

University archivist Terry Birdwhistle and Oral History Program assistant

director Jeff Suchanek will oversee the transcription and archiving of the interviews. Meanwhile, Arcury is seeking additional grants to analyze the information and write a book based on the interviews, do further oral histories covering more topics, and prepare an accompanying exhibit of photos, documents and other materials.

"This project has a lot of potential for scholarship, but also for helping formulate future state and federal agricultural policies," says Arcury, adding that his findings should be ready for presentation at professional meetings next fall. "By understanding what has worked well in the past, we can help Kentucky farmers today."

The commission has funded similar projects at Murray State and Western Kentucky universities.

—Suzanne Froelich

Remaking the Egg

In his quest to improve the nutritionally wonderful but high-cholesterol egg, poultry nutrition researcher Austin Cantor has come up with eggs containing 135-185 milligrams of cholesterol apiece—a happy result considering the USDA's typical rating for a large egg is 213.

But as so often happens in research, he isn't certain just where he went right.

Cantor, an associate professor in the College of Agriculture, added beta-sitosterol, a plant sterol known to decrease cholesterol absorption, to the food of 36 hens for 28 days to see if that produced lower-cholesterol eggs. The eggs collected from these hens on Day 28 were indeed low in cholesterol—but so were the eggs collected on Day 1. Statistically, the dietary additive had little effect.

So Cantor is studying other possible

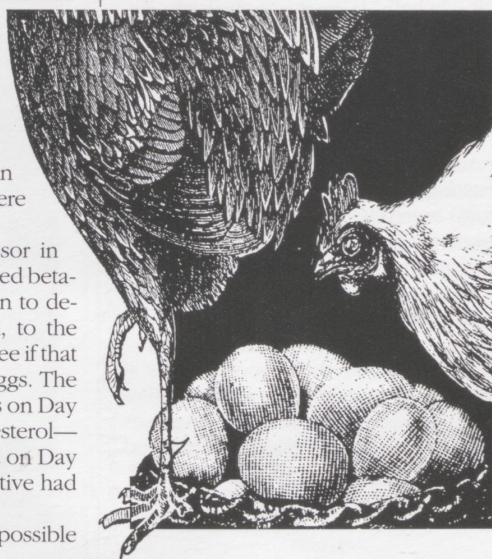
causes for his findings. One may be the strain of hen used—a high-producing Single Comb White Leghorn. "We are saying this strain produces eggs lower in cholesterol and maybe other strains do too," says Cantor.

Another cause may be the hens' production rate. "The hens we used are high producers and there tends to be an inverse relationship between high egg production and low-cholesterol eggs."

A third factor is today's improved technology for measuring cholesterol in eggs and other foods, says Cantor. As techniques, such as the high-performance liquid chromatography that Cantor used, become more exact, values tend to get lower.

Meanwhile, Cantor is continuing his research at the Poultry Research Facilities at Coldstream Farm, where almost 2,000 hens assist him and other researchers by laying about 1,400 eggs daily. He is analyzing results of a second beta-sitosterol test and planning a third, this one to last a longer time and to include other dietary additives, such as high-fiber ingredients like barley. He is also looking at ways to reduce the cholesterol-rich yolk in eggs.

Cantor says his findings, if not ground-



breaking, are highly interesting, considering the strong desire of the egg industry and the public for a more healthful variety of nature's near-perfect food. Despite their high cholesterol, eggs are relatively low in saturated fat, versatile and one of our best sources of protein.

"Through genetic selection and dietary manipulation, the average cholesterol value of eggs will continue to go down, and could be as low as 160 someday," he says. "For someone trying to keep their cholesterol intake to near 300 milligrams per day, that means two eggs for breakfast instead of one."

—Suzanne Froelich

Appalachian Action Primers

Lack of jobs is an omnipresent issue for the hard-hit communities of Appalachian Kentucky. And a booklet published last spring by the university's Appalachian Center drew media and Congressional attention by suggesting unemployment in the region is dramatically higher than thought.

In "Jobs & Economic Development: Meeting the Needs of Appalachian People," writer/researcher William Keesler notes the official unemployment rate for Kentucky's 49 Appalachian counties is 15-20 percent, but the real rate is far greater since the state doesn't count job-seekers who stop registering at the unemployment office once their 52 weeks of benefits run out.

Comparing official unemployment figures with workforce data based on population statistics, Keesler came up with jobless rates near or above 50 percent in many counties. These figures triggered newspaper stories across the state, as well as a proposal from U.S. Rep. Chris Perkins that Congress reevaluate how jobless statistics are gathered.

The figures are part of the 23-page

booklet's objective look at four avenues to economic development in Appalachia: expanding existing industry, recruiting new industry, encouraging local entrepreneurs, and improving human services. It also contains two pages of resource help.

The booklet is the first of six planned by the center's ongoing Appalachian Civic Leadership Project, co-sponsored by the university and Berea College.

Modeled after The Kettering Foundation's National Issues Forum, the booklets are designed to serve as primers for community discussions in a region where many residents feel isolated from public decision-makers, says project director Ronald Eller.

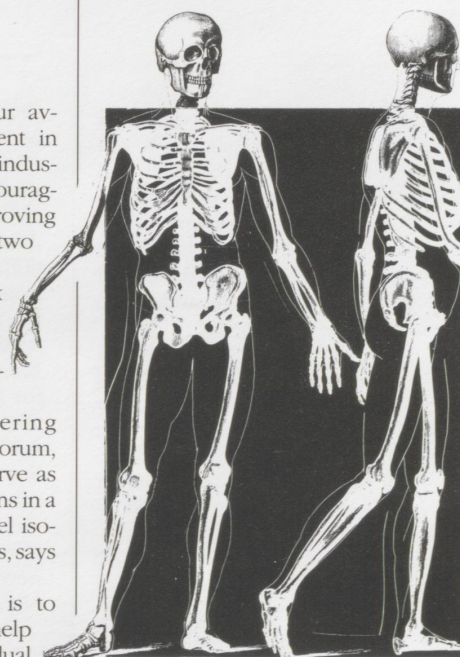
"The focus of the booklets is to provide objective information to help communities move beyond individual interests and find the common ground needed to solve the major problems facing the region," says Eller.

Keesler, a former Louisville *Courier-Journal* reporter who has written extensively on Eastern Kentucky, has completed a second booklet on the environment and is currently researching a third on education. Possible future topics include domestic violence, health-care delivery and quality of local governments.

Some 1,500 copies of each booklet, written at a 9th-grade level, will be distributed through the region's five community colleges to civic and social groups, schools, churches and other gathering centers, says Eller.

Local literacy workers will prepare 5th-grade-level versions of each of the booklets for less advanced readers, says Eller, noting that one-third of Appalachians are functionally illiterate. Also, a videotape version of the series is being considered as a way to reach even more people.

—Suzanne Froelich



Student Interns Make No Bones about Importance of Summer Program at UK

David Adams, a student at Alice Lloyd College in Pippa Passes, Kentucky, plans to become an M.D. and use his knowledge to help the people he's grown up with and known all his life. This past summer, as an intern in the Engineering/Life Sciences Summer Intern Program at UK, he moved a few steps closer to his goal.

"The program was a very positive experience for me. I've not been out of the mountains of Eastern Kentucky very much," says Adams, one of eight Kentucky residents attending UK or other universities who participated in the program. At UK, the group works as a multidisciplinary team to solve various research problems.

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Students were chosen based on their interest in engineering and/or life sciences, their academic standing, and faculty recommendations. The long-range goals of the program are to stimulate interest in the application of engineering principles in medicine and biology and to encourage students to pursue graduate education.

A more immediate goal was to get student assistance in some areas currently under study. "We needed other sets of creative eyes to look at the problems we're trying to work on," says Bill Marlowe, program manager for management and information at UK's Center for Robotics and Manufacturing. Marlowe, along with Charles Knapp, director of the Center for Biomedical Engineering, served as coordinator of the program.

Two biomedical engineering issues were addressed by the interns. The first had to do with precision shaping of bone cavities for orthopedic implants. More precise shaping of the cavity for hip arthroplasty, for example, would mean a more comfortable and stable prosthesis.

While one group of students worked on this problem, another group studied ways in which heat transfer can be reduced during the surgical cutting of bone. The cutting process can produce extremely high temperatures, sometimes in excess of 100 C, which causes necrosis (death or decay of tissue) in the cells of the bone. When necrosis occurs, cells lose mechanical stability and parts of the bone are replaced by scar tissue, which can interfere with and reduce the life of the implant.

All of the students interviewed agreed that the group research experience was a major benefit of the program. Conly Wake, a Lexington resident majoring in materials science at Rice University in Houston, says, "The most fantastic educational thing about it has been the group experience. There are

all the different points of view—everybody has something to add."

Marlowe and Knapp hope to offer similar internships next summer and are seeking extramural funding from government sources, such as the National Science Foundation, as well as from the private sector. The Engineering/Life Sciences Summer Program is sponsored jointly by the Center for Biomedical Engineering, the Center for Robotics and Manufacturing Systems, the College of Engineering, and the Office of the Vice Chancellor for Research and Graduate Studies in the medical center.

(from *Advanced Manufacturing*, newsletter of the Center for Robotics & Manufacturing Systems)

Why Do Teenagers Keep Saying Yes to Alcohol?

*Know when to say when.
Friends don't let friends drive drunk.*

When it comes to drugs and alcohol, just say No.

Despite a bombardment of media messages, tougher law enforcement, and sweeping educational campaigns, alcohol remains the drug of choice among today's high school students, and its popularity remains undiminished.

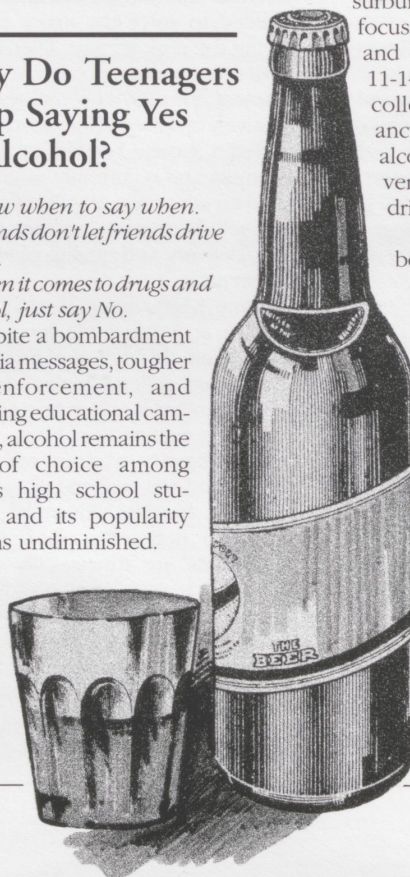
According to a recent survey at the University of Michigan, 92 percent of high school seniors had tried alcohol at least once, two-thirds had taken a drink within a month of the study, and more than a third had been drunk within the previous two weeks. Only 26 percent, by comparison, believed daily drinking would threaten their health or safety—despite strong evidence that alcohol is implicated in the majority of teenage car crashes, as well as many suicides and murders.

How do teenagers develop such attitudes toward drinking? What do they expect alcohol will do to and for them?

Greg Smith, a psychology professor at the University of Kentucky, has found some answers to these questions. In two separate studies in suburban Detroit schools, one study focusing on children in grades 1-5 and the other involving students 11-14 years old, Smith and his colleagues found that expectancy—how the students thought alcohol would affect them—is a very powerful indicator of future drinking behavior.

"Growing up, kids come to believe that alcohol has certain effects," Smith says. "Some think that alcohol can produce a variety of highly desirable, positive effects. The theory is that kids who believe this solidify their ideas about alcohol long before they actually drink, so certain expectancies are already in place and determine, in part, what the real experience turns out to be—it becomes a kind of self-fulfilling prophecy."

In the study of children in grades 1-5, Smith used a standard questionnaire designed to assess seven expectancy factors, ranging



from alcohol's ability to transform experience and behavioral functioning to its ability to help people relax.

The results of this survey showed that although almost all youngsters believed alcohol is bad and that people should not drink, many were at the same time forming positive expectancies for drinking—that if one *were* to drink, it would lead to desirable outcomes.

How is it possible for such expectancies to follow from such negative beliefs about alcohol? Richard Clayton, scientific director of UK's Center for Prevention Research, explains: "Believing, even knowing, something is bad for you is not sufficient to overwhelm all of the other messages—from friends, peers, the media, and society—that most people drink, most people enjoy being disinhibited from time to time, and that alcohol facilitates the experience."

Smith's second study—with 7th and 8th graders—focused not only on self-reported drinking habits, but also on how these habits changed over a five-year period. During each year of the study, begun in 1984, students completed an in-class questionnaire that focused on drinking expectancies and behavior.

There were some dramatic increases in reported drinking behavior among this group from Year 1 to Year 2 of the study. In the first year of the survey, 17.4 percent of the students said they typically drank two to three drinks or more; this percentage jumped to 33.6 a

year later. The percentage of responses to "Get drunk two to four times per year or more" more than doubled, from 10.2 to

24.5, and responses to the item "Get drunk more than half of all drinking episodes" went from 5.7 percent to 14.6 percent. Perhaps most interesting to Smith was the fact that the increased drinking by so many of these students was predictable from the expectancy data.

"What we found," says Smith, "is that the more strongly these students endorsed positive expectancies related to drinking—that alcohol can help ease their social relationships, for instance—the more drinking they would be doing in subsequent years. It turns out that we can anticipate with surprising accuracy which kids are going to develop alcohol-related problems during their adolescent years."

He says that by using such data, school administrators can design programs that are more effective in altering adolescents' expectations concerning alcohol.

Clayton adds that "one possible implication of Smith's research is policy oriented. Perhaps we could begin to affect expectancies by restricting the number, the type, the outlets, and the content of advertisements for alcoholic beverages."

—Jeff Worley

Top Math Students

At a time when the number of Americans getting degrees in math and science is declining, the university's graduate program in math is enjoying "the best year we have had in quite some time" in terms of quality and quantity, says Brauch Fugate, director of graduate studies in mathematics.

Of 22 beginning math graduate

students this fall, four are on full fellowships and six others are on partial Quality Achievement Award Fellowships, which were offered in all disciplines for the first time this year to increase the

university's competitiveness in attracting top graduate students.

"We really feel good about the quality of students coming into our program,"

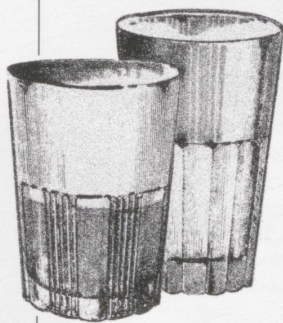
says Fugate.

"The winners of our Quality Achievement Fellowships come from schools all over the country and some students declined offers from

Purdue, Duke, Notre Dame and Michigan to come to Kentucky."

Winners of full \$9,000-10,000 fellowships are Sharon Durall and Jeff Schanding from UK, Michael Raney of Transylvania University, and John Prather, a graduate of the University of Louisville and Vanderbilt Law School.

Students on \$3,000 Quality Achievement Fellowships are Ron Vandenhouten, St. Norbert College, De Pere, Wisconsin; Bob Robertson, University of Arkansas; Laura Schueller, Pennsylvania State University; Susan Lawrence, James Madison University, Virginia; Martha Muenks, UK; and Michael Dobranski, Miami University in Ohio.





Geography Faculty Gets High Research Marks

A recently published study of faculty research productivity has placed UK's Department of Geography 5th among 65 Ph.D.-granting departments in the U.S. and Canada. The findings were published in an article titled "Publications in Leading North American Geography Journals by Ph.D.-Granting Departments." The article, which appeared in a Canadian journal, was based on a study conducted by James O. Wheeler of the University of Georgia.

Wheeler analyzed faculty publications in nine of the discipline's leading journals from 1980 to 1989. The institutional affiliation of the authors was recorded for the 47 U.S. and 18 Canadian departments granting the Ph.D. UK's department ranked 5th in articles per faculty member over the 10-year period. UK ranked 15th when faculty size was not taken into account.

Richard Ulack, chairman of the department, said he was "pleased but not surprised" at UK's ranking. "We don't have one faculty member who's *not* active and productive," Ulack says. He

adds that the department's overall ranking of 15 is also impressive. "With 12 faculty members, we're really a small department; it's significant, I think, that we can compare with UCLA's Department of Geography, which has 19 faculty members."

Ranked ahead of UK were Ohio State University, UCLA, the University of Illinois, and the University of Georgia.

Provan Awarded \$700,000 for Mental Health Study

Keith Provan, professor of management in UK's College of Business and Economics, has received a grant of nearly \$700,000 to study how mental health agencies work together to serve their clients. The grant from the National Institute of Mental Health will fund a two-year project in which researchers will study community mental health service delivery networks in four states.

"Since the 1960s," Provan says, "the general philosophy has been to 'deinstitutionalize' most adults with serious mental illness. The idea is that these people can learn to live reasonably well in society without being cared for 24 hours a day." Unfortu-

nately, says Provan, deinstitutionalization has not worked very well, in part because of inadequate funding and in part because of the difficulties of serving this particular group. Evidence of the scope of the problem is the large numbers of homeless people in our cities.

"The many services these people need to keep them functioning reasonably well are now often scattered across many different agencies throughout a community," Provan says. For instance, someone may have to go to different agencies to handle housing needs, medical problems, legal problems, food and clothing needs, and so forth. "In the communities we will be studying, there might be 40 or 50 agencies serving adults with serious mental illness," says Provan. "This presents a real barrier to effective service delivery, particularly when dealing with people who have difficulties with complex situations."

The study will involve cities of approximately equal size in four states, located in the northeast, midwest, and southwest. Two of the states are regarded as having a high commitment to mental health services, while two have low commitment, Provan says.

"Hopefully," he says, "the results of our study will be used by mental health planners and funders to develop community-based systems of mental health delivery that respond to the considerable needs of deinstitutionalized clients, while remaining sensitive to the needs and differences of the many service providers in most large communities."

UPDATE

Note-Worthy Program Scoring Big

Behind the door of a room in the basement of the Fine Arts building there is a singing butterfly. There may be, in fact, as many as eight singing butterflies at any one time, each of them in constant danger of being swallowed by a frog.

If this sounds like unusual activity for a course in vocal training, stay tuned. The butterfly and frog game is only one of several innovative programs developed by professors Allen Goodwin, Chuck Lord, Peter Simpson and Cecilia Wang in UK's School of Music.

Lord explains: "A student sits at one of the eight computer terminals, which are all hooked up to keyboards. A butterfly flies across the screen and emits a note which comes out of the speaker. The student tries to match that pitch—sings into the computer—and as she lets go of the pitch a line shows whether she's going to hit the butterfly or not. The tongue of the frog will unfurl across the screen at the level where she sang. If the student is accurate, the frog will get the butterfly."

Lord, an associate professor of music, says that this is one approach being used to deal with a traditional problem in vocal training—the need to depend on a teacher to give useful feedback in a singing lesson. "Traditionally," Lord says, "you have to rely on qualitative descriptions like, 'Oh, you were a little high on that 16th note, a little low on that eighth note.' But in the butterfly and frog game, you can see right in front of you on the screen whether you're matching a certain pitch or not."

As a response to what was perceived as several shortcomings in the teaching of music theory and performance, Lord teamed up in 1981 with Richard Domek, now dean of the College of Fine Arts, and music professors Kate Covington and Peter Simpson [see "Bach to Basics with Computers," Spring 1985 *ODYSSEY*] for a "curricular revision project." Funded for 30 months by FIPSE (Fund for the Improvement of Post-Secondary Education), which Domek characterizes as an "innovative, risk-taking" funding agency, the group conceived a technologically assisted modular teaching program.

"What we did, basically, was to take

the material covered in beginning and intermediate music theory courses and divide it into four tracks, each with 12 modules (units) of information—three per semester for four semesters," Domek says. The computers were then programmed with corresponding, complementary software, some commercially available and some developed by Covington and Simpson. The students were required to pass each module before going on to the next one.

In learning music theory, for example, a student now sat at a terminal which had a keyboard overlay of note values and pitches. If she hit the eighth note key, that activated the sound board within the computer to produce an eighth note as the note was represented on the screen.

"What we found," says Lord, "was dramatic improvement by the students, in part because of the increased motivation built into the system. They not only kept up with their lessons, but their grades improved markedly." "There was a much higher proportion of A's and B's," Domek says. "And we feel this is not grade inflation, because the material is the same as it's always been—it's just organized differently."

The modular structure and competency-based testing are still being used in written theory and aural training; in addition, there have been "a number of interesting developments" in the past six years, Lord says.

One recent change has occurred in the teaching of aural training. "We're taking a much more experiential method to aural training than before," says Covington, coordinator of UK's Music Theory Division, "a more intuitive approach. A student uses his instrument or a keyboard now to respond to what he hears musically instead of analyzing the musical passage he hears." The traditional approach, Covington explains, requires a student to listen to a passage and then affix an analytical label to it.

"So instead of calling it a major scale, the student might respond by playing the scale back, or if you're working with harmony, instead of labeling every chord—writing it down—the student



Richard Domek (background) and Chuck Lord discuss the choice of a computer music sequence for a class in aural training.

might play a harmony to the progression, so he's actually using music to respond."

Lord explains that the keyboards students use are "multi-timbral"—many sounds can be produced at once. Using sequencing software, Lord records a piece on the computer. After listening, students are asked to play back—and record separately—different musical elements, such as the melody, the bass line and the chords. Or they may take a given melody and add chords to it. Nan McSwain, a graduate assistant currently teaching a sophomore-level course in aural theory, believes that her students benefit "tremendously" from this approach.

"What I've been doing this week," says McSwain, who is working under the guidance of Simpson, "is giving my students the melody line to 'Love Me Tender.' Most of them know the song, even though Elvis pre-dates them by a few years. They listen to the melody and have to develop the song's chord structure. They're fascinated with this approach—they love to use it," says the Owensboro, Kentucky native.

"Asking for musical responses is a much more creative and practical way to teach students theory," Lord says. "Kate mentioned the other day that a lot of her students now rate aural training as their favorite class instead of their least favorite. It's still problem solving, but it's no longer a classroom paper sort of exercise."

Lord adds that this approach also helps students develop skills they are going to need after graduation. Whether students go on to become performers or teachers, their musical background will be more useful and relevant.

"There's a long-term influence in that at least half of the undergraduates are working on a music education degree and will be out in the public schools before long," says Covington. "The way they've been taught will clearly influence the way they teach."

—Jeff Worley

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