

ODYSSEY



THE
NIGHTMARE
DISEASE:

WORKING
TO PREVENT
THE ASSAULT
OF ALZHEIMER'S

Timmons

EDITOR'S NOTE:

You will find changes in this issue of *ODYSSEY*—some new features and some rearrangement of familiar ones.

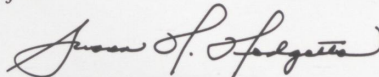
One new feature is titled "Behind the Scenes" and will, in each issue, concern an individual who plays a critical role in the support of research—someone who is part of the research infrastructure. We hope this feature will give you additional insight into the type of complex support system needed for a research university and that it will encourage young people to become technically trained for the many opportunities to participate at an important level in science and research without, necessarily, some of the advanced degrees usually associated with these endeavors. E.B. Yates, the subject of this issue's "Behind the Scenes," is a native of Harrodsburg who used his education at McAfee High School and his experience as a machinist to propel him into a job as a technician in UK's Mechanical Engineering Department. This job developed into a career of almost four decades of working closely with faculty and graduate students to turn their concepts and sketches into complex machinery.

A second new feature is titled "Honorable Mention" and follows the careers of UK graduates who have received a graduate degree from our university. In this issue we look at the accomplishments of six of our graduates—a Pulitzer Prize nominee composer, chair of an international bank, senior director of an international pharmaceutical company, one of the nation's leading experts on U.S. military history, chief of the neuropsychological program at a leading university, and an internationally acclaimed researcher in chemical engineering. They are a source of pride for all of us who have an interest in the University of Kentucky.

Perhaps one of the most delightful aspects of "Honorable Mention" is the deluge of suggestions we received from around campus on who to feature. Now we have a repository of very accomplished graduates to draw on, so this should be an interesting feature for many issues to come.

Some old standards—"Research Briefs" and "Research Results"—have been renamed to more accurately reflect their subject matter. "Research Briefs" is now titled "Kiosk," after the Turkish word for a place to post notices and announcements. "Research Results" has been retitled "Update." With the new title, this feature will be expanded to report on the progress of research efforts as well as the findings of projects that have concluded.

I hope you will find that the new additions and changes enhance your enjoyment of *ODYSSEY*. We are very glad to have you as a reader...your support throughout the past nine years has meant a great deal to all of us.



Susan H. Hodgetts
Editor and Director of
Communications and Advancement



The University of Kentucky, the commonwealth's graduate education and research institution, exists to provide opportunities for the education, personal growth and development of individuals and to contribute to the improvement of society.

With this mission as its premise, one goal of the university is to conduct programs of basic and applied research which support graduate and professional education, provide for the advancement of knowledge, and seek solutions for the acute problems of society.

The university's research mission also acts as a magnet for attracting top graduate students who want to participate in nationally competitive research projects. This research experience can offer them a significant advantage in their education while laying the foundation for future research and development. *ODYSSEY*, through articles about various research projects and graduate education programs, reflects the breadth of the university's search for new knowledge and the myriad of research endeavors underway. The progress that the university has made toward achieving its research mission and securing the extramural funds required to support these types of endeavors would have been impossible without the talents and dedication of our researchers.

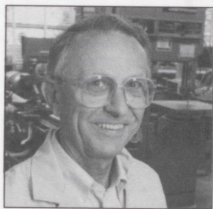
The goal of *ODYSSEY* is to offer the reader the opportunity to share in some of the excitement, curiosity and creativity evident in the research underway at the University of Kentucky.

ODYSSEY

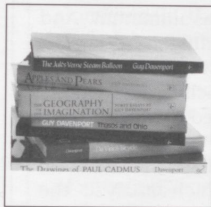
Volume VIII, No. 2



Engineering Success, p.10



Behind the Scenes, p.28



Kiosk, p.31

CONTENTS

The Nightmare Disease: Working to Prevent the Assault of Alzheimer's	2
Engineering Success: Role Models Encourage Minorities and Women	10
Cool, Clear Water: Assessing Kentucky's Groundwater Quality	17
Honorable Mention: The Successes of Six UK Graduates	22
Behind the Scenes: For "Tinkerer" E.B. Yates, Building Another Machine Is Just Routine	28
Kiosk	31
Update: Peter Oeltgen: UK's HIT Man	35

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The Nightmare Disease: Working to Prevent the Assault of Alzheimer's

by Jeff Worley

The topic of interest was aluminum. And many of the physicians and scientists waiting to hear the two speakers at the Meridien Hotel in San Francisco that Sunday afternoon last June expected a knock-down, drag-out confrontation.

Both speakers had done extensive work on trace-element studies, which analyze the amounts of such elements as aluminum, mercury, bromine, and rubidium in the brains of Alzheimer's victims. The research focuses on nerve cells which contain filaments called neurofibrillary tangles, shrivelled strands resembling bundles of straw. These tangles are characteristic markers in the brains of Alzheimer's patients. It was no secret to many of those attending this session that the two speakers, both internationally known experts on Alzheimer's, had reached significantly different conclusions from their research on the role of aluminum in Alzheimer's disease.

First, William Markesbery, director of the Sanders-Brown Center at the University of Kentucky, rose to present his findings to this gathering of the American Association of Neuropathologists. Markesbery, a slender man in his fifties who becomes easily animated when speaking about something that engages his imagination, chronicled the work that he and UK chemistry professor William

Ehmann had done on the amount of aluminum present in the brains, taken at autopsy, of Alzheimer's victims. In bulk studies at UK, samples of brain tissue approximately the size of a pea were taken, and neutron activation analysis was used (the samples were made radioactive so that gamma rays emitted could be analyzed to determine the concentration of aluminum.) In further studies of microscopic samples, UK's Laser Microprobe Mass Analyzer (LAMMA) was utilized. Markesbery reported that no significant elevation of aluminum was found in either study.

Next, pathologist Daniel Perl, of New York's Mt. Sinai Medical Center, took his place behind the podium. Perl, in his mid-40s with black wavy hair and a well-trimmed moustache, has also been using the LAMMA in his continuing study of the aluminum hypothesis. He reported the recent study of 18 different Alzheimer's brains at Mt. Sinai, all of which were found to have significant elevations of aluminum in the telltale tangles. Perl concluded that aluminum toxicity plays a definite role in Alzheimer's.

"People attending this session thought we just might have our boxing gloves on," Markesbery says, a smile easing onto his face. "It was a very nice little session—it attracted a lot of attention, extra time was left for questions, and we came out of it very well, I think." He adds that "it's still a controversial area, very controversial.

"Bill [Ehmann] and I set out to see if we could corroborate the findings of Perl and some others, since there's obvious value in researchers reaching the same conclusions. Bill and I have worked together on this study for a long time," says Markesbery, also a professor of pathology and neurology. "We have looked at a large number of Alzheimer-diseased brains and have built into our work a large number of controls. In our studies, aluminum was not elevated."

Ehmann adds that several other research groups from around the country have also failed to confirm significant differences in the bulk brain levels of aluminum. "Several research groups in the U.S. and in Europe have also been unable to confirm the aluminum hypothesis," Ehmann says. "Research-

ers at Case Western Reserve, St. Elizabeth's Hospital in Washington, D.C., at UCLA and in Belgium have also failed to detect elevated aluminum in the Alzheimer brain. People have applied the very best modern analytical techniques, and what it comes down to is that this determination is a very difficult problem. And no one should be too easily critical that people come up with different results."

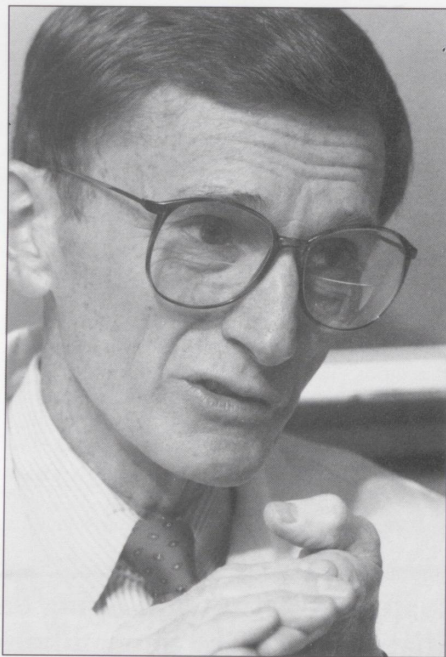
How do Markesbery and Perl account for these divergent findings? "In using the LAMMA," Perl says, "we're working with an extremely sensitive instrument. The repeated firing of the laser, how it focuses and how the detector works all tend to become less standardized through time with continual use, and all of these differences can affect what the spectrum will look like." Markesbery believes that environmental differences may be the key. "Keep in mind that we have studied only the brains of Alzheimer's victims

National Institute on Aging data says that there may be four million Alzheimer's victims nationwide.

who lived in Kentucky. The air quality in their immediate environment, the possibility of a lower level of toxins in the water they drank—these may be factors that account for the differences between Dan's findings and ours."

Both groups—at Mt. Sinai and at UK—agree that the LAMMA is the best available instrument for the microscopic study they are undertaking. (This instrument was purchased by UK as part of the recent \$20 million bond issue.) In the "LAMMA room" on the third floor of the Chemistry-Physics building, Markesbery, Ehmann and graduate student Mark Lovell analyze their samples. First, a brain sample 1/2 micron thick (a micron is one millionth of a meter) is placed in the LAMMA microprobe. Inside, two laser beams converge to form one powerfully focused

continued on page 4



William Markesbery

Both internationally known experts on Alzheimer's reached significantly different conclusions on the role of aluminum in Alzheimer's disease.

beam. This resultant beam is trained on a particular cell, magnified 1250 times, and a hole is blown by the laser into the chosen part of that cell (the cytoplasm, where the neurofibrillary tangles appear, for example). This "shot" area of the cell is instantly vaporized, and positive ions are propelled onto a detector. This energy exchange is calculated by a computer; then the information is translated into a mass spectrum, a graph of peaks and

valleys, which can be punched up onto a computer screen. The area under each peak represents the amount of a trace element.

Despite their divergent findings, the two groups of researchers, Ehmann says, are very friendly. "We exchange ideas, we exchange samples. It is not antagonistic in any way. After all, everybody is trying to find the truth—we need to know what *the primary event* is that causes the disease," Ehmann says. Markesbery adds that the co-chairman of the session in San Francisco made an important summary statement. "Bob [Terry] said something to the effect that 'this is what makes neuropathology so great—we can have disagreements and people work together to try and solve the problem.'" One result of the conference is that Markesbery may soon travel to Perl's laboratory in New York and Perl may bring some of his samples to UK for analysis.

Markesbery says that the aluminum hypothesis is a reasonable one. "Aluminum is the third most common element in the earth—it's all over the place. We purify our water with alum, so we drink aluminum every day. We get aluminum in our antacids, in some of the buffered aspirin compounds, in under-arm deodorant; there's aluminum dust in the air of every room in your house."

And Markesbery and Ehmann emphasize that various trace elements continue to be primary suspects in the etiology of Alzheimer's. Ehmann explains that some trace elements are important in the body's metabolic processes, while others are nonessential and occur in the body as a result of the person's environment.

In their search for an element that may trigger the slide into Alzheimer's, the researchers are shifting their attention to another pervasive metal that is well known as a neural toxin.

Although Ehmann and Markesbery found no significant elevation of aluminum in their samples, they have found high levels of another trace element—mercury. “Using neutron activation analysis, we have consistently found mercury to be elevated in patients with Alzheimer’s disease,” Markesbery says.

He explains that one of the major areas of the brain involved in Alzheimer’s is called the nucleus basalis of Meynert (named after the Viennese neurologist who first detected its importance). It’s in this area that acetylcholine, a neurochemical that has a lot to do with memory, is made. “The major biochemical defect that has been found is in acetylcholine, and in this area of the brain we’ve found a striking elevation of mercury, the highest elevation of any trace element we’ve studied so far,” Markesbery says.

In a recent investigation of possible mercury toxicity, Ehmann and Markesbery used a process called sub-cellular fractionation. Dave Wenstrup, a graduate student in chemistry, used Alzheimer’s brains taken at autopsy. He first chopped some of the frozen brain tissue into small pieces, then ground these in a mortar and pestle. To break down the nuclei of the cells, the brain tissue was then placed in an ultra-centrifuge separator, which resembles a top-loading washing machine. Placed into test tubes inside the separator, the brain fragments were spun at different rates and the fragments, because of their different densities, separated from one another.

“What we wanted to do was find out *where* the chemical imbalances occurred,” Ehmann says. “Were they in the nucleus, the mitochondria, the microsomes?” “We found mercury to be significantly elevated in the subcellular fraction, and most highly elevated in the microsomes,” explains Markesbery. “So if you look at the whole piece of brain or you break it down, you still find an elevation of mercury.”

If high concentrations of mercury do get into the brain, where does the mercury come from? “We have lots of mercury in the environment,” Markesbery says. “Obviously in our fillings—our amalgams are filled with



William Ehmann

mercury. There is mercury in fish, tuna, for instance, and it’s used as a fungicide in paint.”

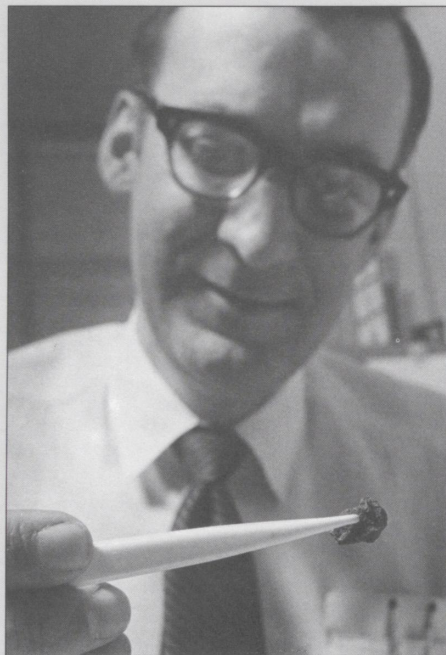
“Mercury has been known as a neural toxin for years,” Ehmann adds. “Where did the term ‘Mad as a hatter’ come from? Well, the people who made hats in England used hot solutions of mercury salts or even hot mercury itself to shape felt hats. As a result, many of the people in the hat business had mental disease from mercury exposure.”

“And there’s a disease that’s fairly well known called Minamata disease,” Markesbery adds. “This was prevalent in the 1950s among those who ate sea food from Minemata Bay, Japan, which contained excessive amounts of alkyl mercury compounds. They suffered nerve cell degeneration and severe neurologic and mental disabilities.”

In the degenerative process of the Alzheimer brain, Markesbery emphasizes the role of the blood brain barrier, a sort of membrane border patrol whose job it is to keep toxic

continued on page 8

William Ehmann: From Meteorites to Dendrites



Ehmann in 1968 with a moon sample brought back from the 1968 Apollo Mission

As a graduate student, William Ehmann spent a lot of his time in outer space.

True, he could be physically accounted for on the campus of Carnegie Tech (now Carnegie-Mellon University), but his thoughts often ranged as far as the asteroid belt between Mars and Jupiter. "My Ph.D. work involved looking for radioactivities in meteorites. By looking at the radioactivities, produced by cosmic rays from both the sun and outer space, it's possible to determine the length of time the meteorite has been in space," says Ehmann. Back then, in the mid-1950s, he had no inkling that this work would eventually lead him to the study of trace elements in the brains of Alzheimer's victims.

Ehmann mentions that in those days meteorites were very valuable and hard to come by. Almost all meteorites were in museums or private collections, so researchers were forced to work with small amounts of the material in their analyses of low levels of radioactivity.

For his post-doctoral work, Ehmann went west to Chicago, where he was supported by an award from the National Science Foundation. "There, at the Argonne National Laboratory, I met Dr. John Huizenga," Ehmann says, "and started to look at the chemical composition of meteorites by using neutron-activation analysis." He mentions that at this time many theories of the origins of the elements were being proposed and that some of the data scientists used in forming these theories were based on the elemental composition of meteorites. "These are the oldest bodies we can get hold of in our solar system," Ehmann says, "and since they have gone through much less 'processing' than the earth, they are closer to the original material from which the solar system was formed." He explains that the earth, in contrast, has changed significantly because of weathering and volcanism.

At the University of Kentucky a few years later, Ehmann continued his analysis of meteorites. "We worked on meteorites here for the next ten years, with grants from what was then the U.S. Atomic Energy Commission, providing data for the theories of nucleosynthesis—

the process by which the heavier elements are produced from hydrogen in the stars."

Then in 1968, Ehmann was selected to be among the few scientists in the world to analyze samples of the moon. "When NASA began planning its lunar mission, the Apollo mission, they began looking for scientists who had expertise in handling and analyzing small samples of materials from space. They had no idea the mission would be so successful. They originally thought the earlier missions would come back with just a few handfuls of material to divide up among hundreds of people doing various projects," says Ehmann. So the selection process centered on researchers who had proven they could do a lot with a little material.

"This was terrifically exciting because there were only about 100 groups worldwide that were chosen—100 P.I.s—and I was the sole principal investigator on this NASA grant."

In the nine years that followed, Ehmann analyzed dozens of lunar rock and lunar soil samples, and he was one of the few researchers that were sent samples from the U.S.S.R. after its Luna-16 space mission in 1971. "These samples came from Moscow and were tiny. The Russians didn't have manned missions to the moon, of course, so what they brought back was scooped up by a robotic arm."

Ehmann says that after this nine-year period, researchers probably "knew as much or more about the chemistry of the surface of the moon as about the chemistry of the surface of the earth." The most significant finding, he says, was that the moon was not as primitive as scientists had hoped and, as a result, was not a good sample for the study of the earliest history of the solar system. "Actually, the moon—with its volcanic activity—has under-

gone a lot of the same processes as the earth," Ehmann says. "We didn't find any deposits of diamonds or gold or other exotic things. It's very ordinary volcanic material."

It was at about this time, in the late '70s, that Ehmann was approached by William Markesbery, director of the Sanders-Brown Center on Aging, and asked to consider a new challenge. "One day my friend Bill Markesbery casually mentioned to me that people were suggesting aluminum might have something to do with Alzheimer's disease, and he asked whether I could measure aluminum in brain tissue. Well, we measured aluminum in lunar rocks and meteorites—it's very easy to do. So I naively said, 'Sure, no problem, easy to do.' And of course I knew nothing about brains at all."

Ehmann admits that in shifting his focus from lunar samples to the human brain he literally went from a rock to a hard place. "The composition of the brain is vastly different, and the elements of interest are much less in the brain. Aluminum, for instance, in a rock sample might be a fraction of a percent to several percent; in the brain it's parts per million or less."

He says that there is also the problem of variability. "Human populations are not all the same—people treat themselves differently. They eat different things; they live in different areas. Rocks," he concludes, "are a bit more predictable."

Ehmann himself confesses to enjoying the unpredictable. "I enjoy a diversity of problems. I'm not the sort of person who likes to do only one thing all the time. I like new challenges. And wherever it might come from, I look forward to the next one." ♦

continued from page 5

elements out of the brain. "The nerve cells in the brain are sensitive, so even small amounts of a toxin can affect them. Perhaps in the case of Alzheimer's patients, this barrier is somehow weakened so that larger amounts of

“Within the next five years, we’re probably going to have a drug that will enhance memory.”

toxins penetrate and alter the nerve cells.”

Whether it turns out that mercury plays a major role or not in the etiology of Alzheimer's, both Ehmann and Markesbery agree that the disease is probably the result of multiple factors. "There are some very bright researchers who believe that all cases of Alzheimer's are inherited," Markesbery says. "I don't believe that, but at least 30 to 40 percent are familial, or inherited, and we're starting to understand which genes these patients carry that are associated with the disease."

"It's becoming clearer and clearer," Ehmann adds, "that Alzheimer's isn't caused by something simple, just as cancer is not caused by something simple. It's quite possible that a genetic defect such as familial Alzheimer's makes the brain susceptible to a neuronal toxin, perhaps mercury, that can then penetrate the cell wall where it wouldn't enter in a system that didn't have that defect." It is even possible, though both researchers believe it to be improbable, that Alzheimer's disease is caused by a generalized metabolic defect in all brain cells or that it is caused by a slow-acting virus.

Although the cause or causes of the disease remain elusive, Markesbery points out that in the past five or six years an immense amount

of information has been gathered. "Funding from federal and private agencies has allowed researchers to accumulate a lot of new data. There are 15 centers around the country evaluating large numbers of patients and doing autopsies, and that data is all being put into data banks." Currently, the centers are working together to create a computer network so that all information can soon be shared.

And while Markesbery doesn't believe this data analysis is likely to lead to a cure—at least anytime soon—he does think that it can lead to the eventual prevention of the disease. "Prevention is the correct term, really, because the changes that take place in the brain are so severe that it is highly unlikely we will find a drug or drugs to reverse that process. So what we have to do is prevent it."

Prevention, Markesbery admits, is going to become more and more crucial as the population as a whole continues to live longer. The rate of those with "probable Alzheimer's" (the disease can be positively identified only at autopsy) rises sharply with age: three percent of those between 65 and 74 suffer from the disease, and almost half of people over 85 are victims. Based on that data, the National Institute on Aging says that there may be four million Alzheimer's victims nationwide. And with the over-85 population set to quadruple, given the aging of those born during the baby boom and longer life expectancy, there could be as many as 14 million Americans with Alzheimer's disease by the middle of the 21st century.

With no cure in sight and with an increasing number of people nationwide being diagnosed with Alzheimer's, what keeps researchers and caregivers from becoming demoralized?

"The possibility in our research that we might understand the etiology of the disease, how it progresses, is extremely challenging and worthwhile," says Ehmann. "It's a challenge to do something about a situation

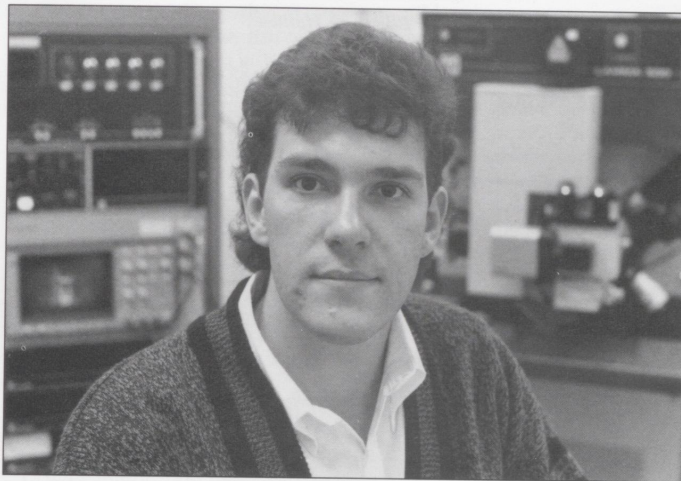
that's affecting four million people in the U.S. If we can find some answers, that would be wonderful."

"Each Alzheimer patient and each family feels the pain of Alzheimer's disease differently," says Markesbery, who also regularly meets with and counsels patients and their families. "There is no more dehumanizing disease in the world than Alzheimer's disease, so it's true that it's depressing, but when you meet one of these individuals, that only underscores the magnitude of the problem. If I hadn't wanted to be a part of something this exciting and wanted instead to do something to make people happy, I think the ideal job would have been to go out and drive an ice cream truck and make all the children in the world happy. But some of us chose not to go into the Good Humor Business and got involved instead in things that are a little tougher."

At present, Markesbery says, virtually the only treatment for Alzheimer's victims is to alleviate the anxiety and depression that often result. Around 20 drugs are under development, most of them aimed at improving patients' memory and cognitive abilities.

"Within the next five years, we're probably going to have a drug that will enhance memory," Markesbery says. "There are too many drug companies working on this and too many ingenious pharmacologists for this not to happen." The development of such a drug would keep people functional for a longer period of time and perhaps keep them out of nursing homes. It would also decrease the cost of Alzheimer's considerably at the front end and allow people to have a better life, Markesbery says.

He emphasizes the point that although Alzheimer's patients can't be cured, they can be helped. "What you hope for is that somebody will love them and care for them because there is no way to reverse the disease, and the basic drive we all have is the need to be loved. Beyond anything medicine and physicians can do, we have to do our best to care for one another. Basically, that's the message of life." ♦



Mark Lovell, from Mt. Vernon, Kentucky, is using the LAMMA to complete his dissertation, which will focus on the toxic trace-element hypothesis of Alzheimer's disease.

Engineering Success: Role Models Encourage Minorities and Women

by Elizabeth Hansen

Before young people can dream of being doctors or scientists or engineers, they must understand what doctors, scientists and engineers do. They must also see people like themselves in those roles. Without such visualization, young people cannot dream of what they might be. And without dreams, they won't become.

Two University of Kentucky recruitment programs have a common goal: to increase the number of minorities and women choosing science and math-related careers. While both programs use role models to increase students' interest, they are aimed at students at opposite ends of the educational spectrum. Project SMART (Science, Mathematics and Rising Talent) targets minority chil-



dren in grades three, four, and five. POWER-MS (Production of Women Engineering Role-Models), on the other hand, is designed to increase the number of women pursuing Ph.D. degrees in chemical engineering.

Both programs developed in response to labor market predictions and statistics regarding the number of minorities and women in scientific fields. By the year 2000, women and minorities will constitute about 85 percent of the new entrants into an American job market that demands employees skilled in science, mathematics and technology. Yet few minorities and women are choosing careers in science. In 1989, only four African Americans received doctoral degrees in science or math in the United States. The proportion of black students in UK's science-based professional programs—such as medicine and dentistry—is less than half their proportion of Kentucky's population. While women constitute about 28 percent of undergraduate chemical engineering majors nationally, only about 13 percent of Ph.D. candidates are female. And women account for only three percent of chemical engineering faculty.

The UK faculty members who initiated and direct the SMART and POWER-MS programs hope their efforts will help change these statistics.

Project SMART arose from frustrations felt by John Wiggs, director of UK's health careers program, and members of that program's advisory board. Wiggs has conducted a number of short-term recruitment and retention programs aimed at minority high school and college students. Those programs are beneficial and will continue to be offered, Wiggs says, but they have not increased the number of minorities choosing health-related careers.

"What we ended up doing was not increasing the size of the pool at all but vying with other universities for the same students," Wiggs says.

Research shows that interest in science and mathematics begins early, perhaps as early as second or third grade. "So we thought our intervention program—any intervention program—should start at least that early," Wiggs says. From that premise, Project SMART evolved as an early intervention program to

enrich the science and mathematics experiences of elementary-aged children. It does not replace the regular math and science curriculum. Now in its second year, Project SMART is a cooperative program of the University of Kentucky and the Fayette County Public Schools, with additional funding coming from the Kentucky Department of Education.

A pilot project for about 150 students in grades three, four, and five operated at Booker T. Washington Elementary School during the 1989-90 school year. Wiggs said Booker T. Washington was chosen for the pilot because it's small, its enrollment is 65-70 percent black and it has fewer resources than most Fayette County schools (it was the only school in the system that did not have a PTA last year, for example). The school also had a "very receptive principal and teachers who wanted to do something different and wanted us there to try to enhance the education of their students."

Using about 25 UK students as volunteers, Project SMART provided one science or math-related experience a month for all children—not just minorities—at each grade level. On the first visit to the school in November 1989, all volunteers were medical and dental students; about half of them were black. Meeting with the children in small groups, the students explained how they came to be in medical or dental school. The volunteers also brought along microscopes and stethoscopes. Each volunteer worked with a group of five or six children so that each child had a chance to peer at a slide under a microscope and listen to her own and others' heartbeats.

One of the minority volunteers, medical student Tracy Nailor, talked about the value of Project SMART in a videotape produced by Fayette County Schools last year: "It's good for the students, especially minorities and underprivileged children, to see other students like themselves excelling in careers that for a long time we've been told as a people that we cannot do or we don't have the ability to do . . ." Also valuable to the children, Nailor says, is the "one-on-one contact they get with us. It's that participation that they're allowed to get with the SMART program experiments that tells them science and math can be fun; it can be interesting."

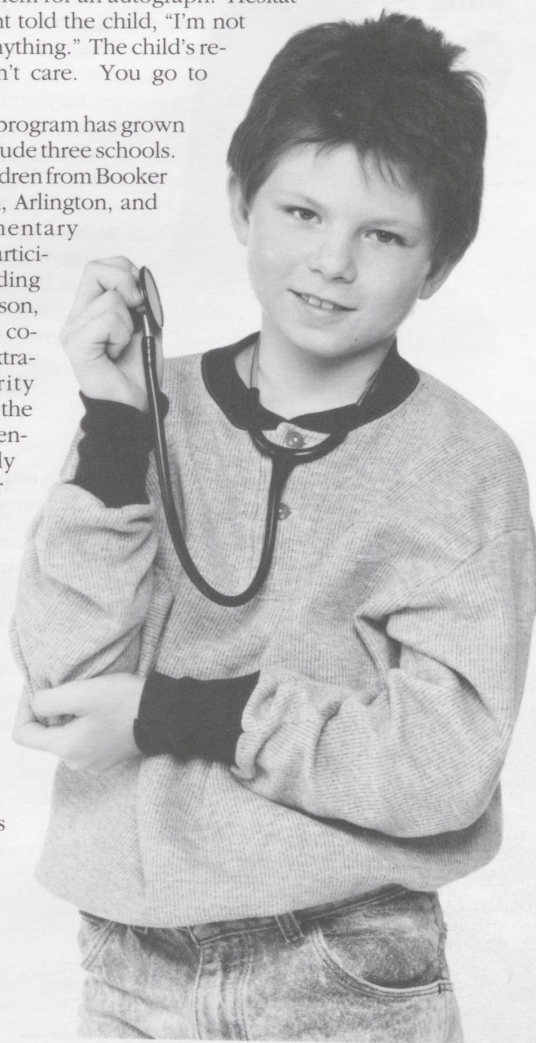
Frank Kendrick, a dental student, adds another benefit to the list of the program's strengths: "I think most kids are just utterly fascinated and amazed that someone is really doing this. They're not accustomed to seeing someone in these types of professions who comes down to their level and communicates with them."

Wiggs agrees with the students' assessment of the program. He recalls one fourth grader who was so awed by the UK students that he asked one of them for an autograph. Hesitating, the student told the child, "I'm not an athlete or anything." The child's response: "I don't care. You go to UK."

The SMART program has grown this year to include three schools. Almost 500 children from Booker T. Washington, Arlington, and Russell elementary schools are participating, according to Juanita Peterson, who has been coordinator for extramural minority programs for the UK Medical Center since early August. Her primary duty is coordinating the S M A R T program.

The major part of her job involves recruiting, training and scheduling the 86 volunteers needed each month to work with small

Charlisa Chandler, p. 10, William Billiter, below, and Sherry Day, p. 12, are among the students at Booker T. Washington Elementary School in Lexington who are participating in the SMART program.



continued on page 12

Wiggs recalls one fourth grader who was so awed by the UK students that he asked one of them for an autograph.

groups of about six students in the schools. Finding people who want to work with the program has been fairly easy, Peterson says, but scheduling them into the time slots the schools have set aside for SMART activities has proved more difficult.

In October, Peterson arranged role model panels that visited each third-, fourth- and fifth-grade class. Panelists were students from medicine, allied health, nursing, pharmacy, dentistry and engineering and their professional counterparts from the community.

"The children love the students from UK. It is important for them (the children) to see someone who is established also," Peterson says. The professionals can add perspective: "They (the students) are aspiring; we have become."

In addition to telling the children about their professions, panelists discussed the importance of mathematics and science in daily life and the hidden connections of math and science to the real world. Panelists also highlighted the importance of setting goals, attaining an education, striving toward excellence and seeking positive role models.

The experiments and projects children participate in in the SMART program show them how science and math are used in their every-

day lives. For example, during the pilot project one group of students used measuring devices to calculate the relationship between their femur length and their height. In another experiment children observed the diffusion of fluids through dialysis tubing to determine the relative speed of osmosis among various fluids.

This year's experiments were selected by the Fayette County Public Schools' science and math coordinators and the elementary math and science resource teachers with the assistance of Michael Howard. Last year's coordinator for math and science, Howard is no longer with the school system, but continues to serve on the SMART advisory board.

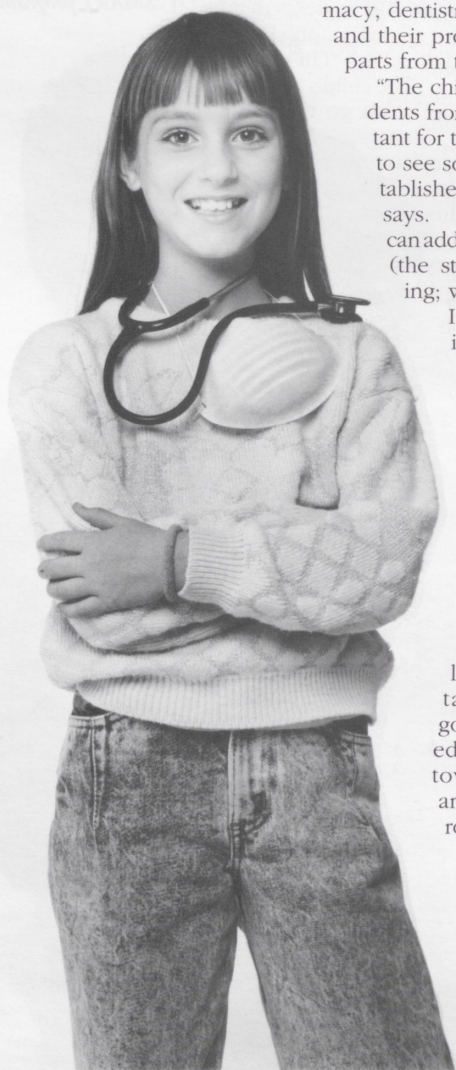
Volunteers who conduct the experiments don't need any special knowledge. Before going into a school to conduct an experiment, volunteers attend a two-hour training session to learn what to do. The training is being videotaped by the county school systems so that classroom teachers can see in advance what the experiments involve, Peterson says.

In addition to the experiments, each grade level will also take a field trip in the spring. Third graders will visit the new Lexington Children's Museum and the UK campus; fourth graders will go to the Armin D. Hummel Planetarium on the campus of Eastern Kentucky University in Richmond; and fifth graders will travel to the Museum of History and Science in Louisville. The year will culminate with "SMART Week" in May when students will be recognized for participating in the program.

Project SMART gives children an opportunity to see that they can achieve goals, Peterson says. The close relationship between volunteers and the children is also important. "Successful people can pinpoint people who made a difference, who helped them realize their potential, who helped them realize they could be successful no matter what they choose to be," Peterson says.

Peterson's point mirrors what Katie G. Jenkins, principal (now retired) of Booker T. Washington school during the pilot program, wrote in a letter to Wiggs last summer:

"The results (of SMART) far exceeded anything we could have expected. Students accepted challenges that would have been rejected at one time. It was rewarding to see





Juanita Peterson and John Wiggs

their positive attitudes of 'I can' or 'I'll try.' Demonstrations, planned by the students, were an inspiration to them, in that they could see what they were able to accomplish. That made SMART worthwhile because, as you know, once students have achieved a degree of success with a project, they continue to try harder next time."

In a formal evaluation of the pilot program, Finley Helm of Kentucky State University concluded that the program was off to an excellent start. He reported that teachers at the school saw the greatest benefit of SMART to be the role modeling done by the University of Kentucky students.

What the long-term results of SMART will be are unknown. Only as students move through the educational system and their success in science and mathematics-related endeavors is measured may the success or failure of Project SMART be evident, Peterson says.

There's more demand for the program than can be met currently. "Schools are in line waiting to get involved with this program," Peterson says. How many schools will be served eventually "will have a lot to do with funding."

Another concern of both Peterson and Wiggs is what will happen with the children after they leave fifth grade. "Early intervention is wonderful, but you have to continue intervening, nurturing, enhancing, encouraging throughout [the children's] educational careers," Peterson says.

What happens after fifth grade—a Project SMARTER perhaps—is being addressed by a steering committee which will also track students' success. A 32-member advisory board, made up of representatives from the university, the school system and the community, serves as the primary advocate for the program in the community and is working to identify funding sources.

Kendrick, who is now doing a general practice residency in dentistry at UK, undoubtedly would argue for Project SMART. In the school system videotape, he talks about his own experiences of growing up in Lexington housing projects. He didn't know a dentist to emulate, but he did have an adult who believed in him and his abilities.

"I never had a role model of a dentist. Why am I a dentist now? Why am I aspiring to be a dentist? Why am I going to graduate from dental school? I don't know, but I know that my mom taught me that I can do a whole lot more than people tell me I can do or people allow me to do," Kendrick says. "If you can't dream of being something, you're never going to be it."

**“If you
can't
dream of being
something, you're
never going to be
it.”**

*A few of the 3rd grade students at
Booker T. Washington Elementary School
who are participating in the SMART program*



**POWER-MS
fellowships are
worth \$19,000
annually and
the new
WENDI
fellowships are
worth \$25,000
for four years.**

For Sue Strange, the dream of earning a Ph.D., teaching college and conducting research blossomed during her undergraduate days at UK. She received her bachelor's and master's degrees in zoology in 1971 and 1973. Seeing zoology overcrowded with Ph.D.s and having always had an interest in math, in the mid-'70s she began taking undergraduate classes in chemical engineering, which was also her husband Terry's field. Then the first of two daughters was born in 1977, the family moved away from Lexington, and she dropped out.

"But the dream never died," said Strange, 40, of Madison, Indiana, one of the first participants in the POWER-MS program. Strange found out about the POWER-MS program from her husband, who learned about it while at UK on a recruiting visit for the chemical company he works for.

After "staying home, playing with the kids and making Jello" for a decade, Strange says she felt unsure about her ability to return to school. It was the confidence Kimberly Ward, assistant professor of chemical engineering and director of the POWER-MS program, expressed in Strange's ability that helped her decide to seek a Ph.D. in chemical engineering.

Strange is now one of four Ph.D. students

in the POWER-MS program. Funded by the U.S. Department of Education and the UK Graduate School, the program provides seven fellowships for students pursuing Ph.D.s in chemical engineering. While the program is designed primarily for women, three of the seven slots can go to men. Two of the fellowships are held by women and two by men. Although the fellowships have been available since January 1989, three slots remain unfilled, which illustrates why POWER-MS was needed in the first place—the small number of women pursuing Ph.D. degrees in chemical engineering and the even smaller number of female chemical engineering faculty at American universities. Lack of female role models has been identified as a reason it is difficult to recruit and retain women in engineering programs.

Ward expected it to be difficult to fill the slots. "The job market [in chemical engineering] is really good right now and it's really difficult to get graduate students—male and female," she says. She expects more fellowships to be awarded later this year and for the funds to be extended beyond the original three-year grant period.

To interest women in the chemical engineering Ph.D. program, Ward and others in the College of Engineering have recruited vigorously. For example, a summer research program for undergraduate women was established to introduce prospective graduate students to the POWER-MS fellowships. A phonathon was organized to contact other chemical engineering departments to obtain lists of students interested in graduate school. Those students were then contacted individually. A videotape was produced and shown at mixers at professional meetings. The efforts (many of which were devised by Charles Hamrin, chairman of the chemical engineering department) have begun to pay off.

"It took us a while to get students, but I think it has really turned us around as far as getting more women in," Ward says. Not only has UK seen a turnaround as far as women students

Sue Strange



Cool, Clear Water: Assessing Kentucky's Groundwater Quality



Kimberly Ward

coming into the program, but a number of UK's undergraduate chemical engineering majors are going on to get Ph.D.s elsewhere. "I think role modeling has a lot to do with it," says Ward, one of two female faculty members in the College of Engineering.

The importance of female role models in attracting women to engineering was expressed in a letter Ward received from Anne Sullivan, one of Ward's undergraduate students who turned down a POWER-MS fellowship to enter graduate school at Georgia Tech. Sullivan wrote: "I want to personally thank you for directing me towards . . . graduate school. You have been a wonderful role model for me. I hope, in the future as a professor, I will be able to help students as much as you have helped me."

In order to attract women, an engineering program needs a "critical mass" of female students in order to attract still more students,

Ward says. Women are more likely to enroll in a graduate program where other women are enrolled, and undergraduate women are more likely to consider graduate school if they see women in the graduate program. The presence of female faculty members is important at both levels.

Ward knows first-hand what it is like to be the only woman. "I can remember when I was an undergraduate, I went into my first class and I was the only female student and I was ready to walk out," she says. "It was strange and you did feel awkward. It wasn't that the male students in the class treated you any differently. It's just that psychologically you felt different being in the class with all men. And . . . I could never skip class. If I skipped class, the professor knew and would say something to me," Ward recalls with a smile. "It's nice to have someone of your own gender to sit and talk to. I just felt a lot more comfortable once there were more women in the program," she says.

"When I came to UK in 1987, I didn't think about my being the only woman (then) on the faculty until I walked into an engineering college faculty meeting and I looked around and that's when it hit me. The whole time I was an undergraduate, I never had a woman faculty member and you do go through school feeling like it is a man's field."

Why did Ward stick with chemical engineering? "Because I've always been interested in teaching and I've always wanted to be able to influence students, to be in a position to work with students."

Now she wants to make sure that women

“ The whole time I was an undergraduate, I never had a woman faculty member and you do go through school feeling like it is a man's field. ”



Sherry Pofahl

entering chemical engineering have other women as role models.

Both Strange and Sherry Pofahl, 28, who also has a POWER-MS fellowship, say having Ward as a role model is a benefit of attending UK, but both are also quick to point out that male faculty members have been supportive and helpful, too. While the POWER-MS program was a major reason Strange chose UK, Pofahl came because her husband is a resident at the UK Medical Center.

Strange, Pofahl, and the two men in the program, Mike Williams and Paul Everman, come from a variety of educational backgrounds. Pofahl and Williams both have degrees in chemical engineering; Everman has completed two years of medical school and will return to medical school after completing his Ph.D. in chemical engineering with a goal of doing medical research.

Without a background in chemical engineering, Strange took advantage of the program's "fast track" curriculum when she returned to school in January 1989. While on the fast track, she took undergraduate courses she needed before beginning the graduate program.

POWER-MS fellowships provide a stipend and pay for tuition, books, travel to scientific

meetings and research supplies, making each fellowship worth more than \$19,000 annually. The fellowships are restricted to U.S. citizens who hold undergraduate degrees from American universities. "There's not only a problem with lack of women but there's also a problem with lack of U.S. citizens, and we need to get more of them into the graduate program," Ward says. As is typical of many chemical engineering departments, half of the students who have received Ph.D.s in chemical engineering at UK earned their baccalaureate degrees abroad.

For Strange, the POWER-MS fellowship has meant she could return to school without draining her family's finances. She sometimes avoids the two-hour one-way commute from her home in Indiana by staying in Lexington one or more nights a week. Her husband and

Lack of female role models has been identified as a reason it is difficult to recruit and retain women in engineering programs.

her daughters, now 13 and 11, have all been supportive of her returning to school, she says.

Ward has recently received funding for another program that will bring more women into the graduate chemical engineering program. Called WENDI (Women Engineering Doctoral Incentives), the program will provide three \$25,000 fellowships for four years. WENDI is funded by the National Science Foundation's graduate engineering education program.

The POWER-MS program is the first of its kind Ward is aware of. She said she has been receiving calls from other universities that want copies of her proposal for the program so that they can start similar programs.

Seeing the irony of another university modeling a program after the one she devised, Ward, a smile on her face, asks: "What would you call that? A role-model program?" ♦

Cool, Clear Water: Assessing Kentucky's Groundwater Quality

by Jeff Worley

When Gary Felton offered to show me how he takes samples of water from a stream, here's what I pictured: the researcher on his knees at the edge of turbulent water dashing over jagged rocks—one hand clutching a ragged tree branch for support, the other hand quickly scooping up in a test tube what water he could reach. I imagined that good balance and a sure hand would be two of the prime requisites for a groundwater hydrologist.

On our way to the stream—out Versailles Road, south on Shannon Run Road, then left onto McGee Lane—I shared this vision with Felton, an assistant professor of agricultural engineering at UK. As he eased his Dodge truck down the steep driveway past the Garrett apple orchard, I wasn't sure exactly what was behind the good-natured smile that had eased onto Felton's face. "I think you might be kind of surprised by how we do this," was all he said.

Joe Garrett's spring (Felton characterizes Garrett as a "wonderfully cooperative landowner") is one of several groundwater sites in Kentucky that will be used as a test site in a project resulting from a recent General Assembly mandate. Because the majority of rural Kentuckians rely exclusively on groundwater for drinking, and since groundwater is a vital resource for agricultural, commercial and industrial purposes, legislators decided that the state should manage groundwater. And as part of this undertaking, the UK College of Agriculture has been asked to assess the current effect of agricultural practices upon groundwater resources and to suggest ways to manage practices that may undermine the quality of groundwater.

At the end of the driveway, Felton stopped the truck and we slid out. We tramped through hip-high weeds and bramble, and when we got to the spring, Felton pointed to two large water maples on the other side of the calm water. "That's the point of origin," he

continued on page 18



*Gary Felton at
Joe Garrett's spring
in Fayette County*

“Ninety-four percent of the wells sampled met the U.S. EPA standard for nitrate-nitrogen.”



Joseph Taraba

said. “A weakness in the geology of the area allowed surrounding water to move down and form this solution channel. This spring is probably the third largest in the inner-Bluegrass region.”

Then he turned and unlocked a wooden shed, slightly larger than an outhouse. “In here—” Felton said, “*this* is where we take our samples,” pointing out that the shed is necessary as a way of stabilizing the climate of the samples. In the half-light, I could see tubes running into a large hard-plastic container which resembled an oversized picnic cooler; the tubes led out the back of the shed and into a large fiberglass trough.

“That’s called a flume,” Felton explained. “A pressure transducer in the bottom of the flume tells us the depth of the water running through it. We’ve calibrated it so that we can determine the flow rate once we know the depth.” The rate of flow is measured and charted inside wall-mounted instruments that look like gas meters, and Felton takes the data from there. The samples themselves, programmed to be taken at regular intervals, are passed on for analysis to Jim Crutchfield in UK’s Agronomy lab.

When I pointed out that the equipment

didn’t seem all that sophisticated, Felton replied, “This is not the cutting edge of technology. The cutting edge of technology breaks down too often.”

Felton and others at UK who do this type of sampling may soon find themselves in the field more often than usual. The conservation, protection and proper use of water has become an increasingly important issue in Kentucky as a result of population expansion and concentration, industrial growth, and a growing demand for water for industrial, municipal and recreational use.

In a recent preliminary study of water quality in Kentucky wells initiated by the Kentucky Farm Bureau, 900 water wells were tested for nitrate contamination and concentration of other inorganic compounds. “Fewer than six percent of these wells tested had detectable levels of nitrate contamination,” says Joseph Taraba, UK associate professor of agricultural engineering. “And only one out of 200 wells tested showed significant levels of triazine herbicide chemicals—atrazine, cyanazine or simazine.” Herbicides are used by farmers and others to destroy weeds and other plants that inhibit crop growth.

This survey, sponsored jointly by the Kentucky Farm Bureau, the UK College of Agriculture, the Kentucky Division of Conservation and the Kentucky Department of Agriculture, asked rural residents in nine Kentucky counties to submit well and spring samples for evaluation. Everyone who submitted a sample was given the test results.

“Ninety-four percent of the wells sampled met the U.S. EPA standard of ten parts per million of nitrate-nitrogen,” says Taraba, who was one of the project’s technical advisers. He explains that nitrate is a compound that can come from a variety of sources, including poorly constructed septic systems and wells, animal wastes, nitrogen fertilizer runoff and natural biological sources. Since the samples were voluntarily submitted by rural residents, it is difficult to estimate a regional or statewide level of nitrate concentration.

“One question that comes into this,” Taraba says, “is ‘Are EPA standards good enough?’ Some environmentalist groups question those health limits, believing that any manufactured chemical in the drinking water is a

problem. They say the EPA is imposing a risk on them that they're not choosing to take by its setting a limit. They wonder if they can trust it. Personally, after looking at how these health standards are established, I feel pretty confident in them."

One reason why some of the samples may have been above EPA standards is the age and condition of the well itself. "We suspect that many of the people submitting samples did so because they were concerned about an older well or one they may have considered to have been poorly constructed," Taraba says. "And based on this survey, we do see that older wells are more likely to show contamination." Of the wells built between 1900 and 1949, 13 percent showed nitrate contamination, compared with just over four percent of wells constructed since 1970.

Another factor related to nitrate contamination is the construction of the well. "Dug and driven wells were 3.4 times more likely to show contamination than drilled wells," Taraba says. "And shallow wells were 2.3 times more likely to have higher-than-desirable levels of nitrate." These factors have been seen repeatedly in studies conducted in other states.

A third contributor, Taraba says, is the location of the farmer's septic tank. If the septic tank and its drainage field is "upflow" from a well where the groundwater moves down, then the septic flow is toward the well. In this case, moving the well to another location or rebuilding the well would most likely result in a cleaner water supply.

State Conservation Department official Steve Coleman terms the initial testing a success and an important first step in a comprehensive assessment of the state's groundwater resources. "This kind of information is vital for farmers and other rural residents who depend on safe well water for use in their homes and on their farms," Coleman says.

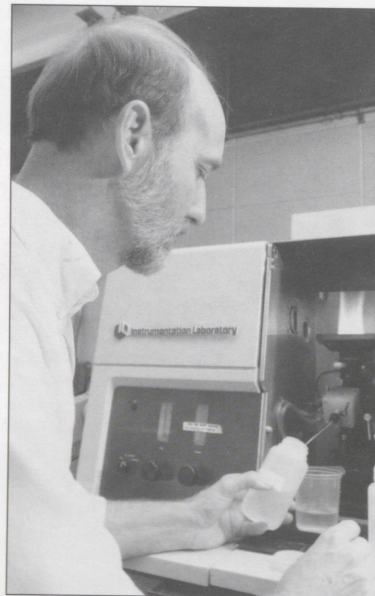
Recently passed Senate Bill 271 charges the College of Agriculture with the responsibility of assessing the impact of agricultural practices on groundwater quality in the state. Taraba points out that this action originated through the combined efforts of farmers and farm organizations. "The bill came primarily

because interested agricultural people in the state wanted more information on water quality than was available. The farming community and the Farm Bureau were solidly behind Greg Higdon and Joe Wright, co-sponsors of the bill."

And unlike some measures which are passed in reaction to a problem in the state, this bill takes what Taraba calls a proactive stance. "It isn't as if people were saying, 'We've got a problem with our water, so let's see what we can do about it.' We're involved in a proactive inquiry—simply gathering information to see if there are problem areas or not." Taraba adds that a lot can be learned even if few problems are found. "If we don't find a problem at a spring we sample, we want to know what farming practices are working well to achieve that outcome. Maybe these approaches can be applied in areas where the water quality isn't as good."

Within the next few months, six to 10 groundwater sites will be selected for intensive study to meet the goals of the assessment period. The study areas will ideally be small and well defined, with the majority of the land under active agricultural use. All streams or springs sampled must flow on a year-round basis, and site selection will involve close collaboration with local UK extension personnel and landowners. Each study area will be fully characterized by UK agronomists, geologists and agricultural engineers, who will record and describe land use, soil tillage and management practices, cropping systems, livestock numbers and waste management, agricultural chemical use, soil type, geology, topology, rainfall, and stream and/or spring flow.

"Right now we have two sites established



Jim Crutchfield analyzes the potassium in a groundwater sample by using atomic absorption spectrophotometry.

continued on page 21

Rainy Days at Spindletop Could Mean Brighter Days for Kentucky Farmers

When UK researcher Bill Barfield drives out to Spindletop Hall, you can be sure a rainstorm is soon to follow.

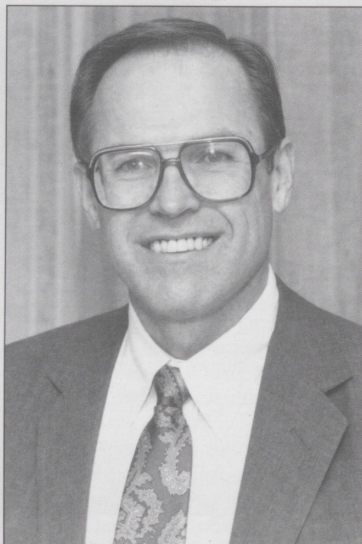
Barfield, a professor of agricultural engineering, is currently working with professors Bob Blevin, Dan Carey and Bill Evangelou on a project that may aid farmers in soil management practices and improve the quality of their water. This work starts with a little rainmaking.

"It's called the Kentucky Rainfall Simulator," Barfield says, gesturing toward the 20-foot-long pipes that run parallel to the plot of land, twelve feet above it. "The Simulator is made up of five sections, and each section covers an area 20 feet by 15 feet," he explains. The sections are hydraulically linked and, since the whole assemblage is on wheels, easily moved. The portability of the rainmaker, which Barfield built, is a unique feature of this apparatus.

He switches the system on, and water begins to shower down from aluminum nozzles which oscillate back and forth from each of the pipes. The shower soon becomes a well-contained rainstorm, water pelting the erosion plot until—one hour later—up to 2 1/2 inches of rain can be measured.

He explains that chemicals are added to the surrounding man-made corn plots just as they would normally be put on corn. "Of course the rain washes some of those off," Barfield says. "We rain on the plot this hard because we're interested in worst-case scenario—our results will reflect chemical run-off at its worst, so usually the situation will be a lot better."

During the hour-long period, samples are taken in plastic bottles every three minutes—as the run-off enters and leaves grass filter strips



Bill Barfield

which border the inclined plot. The strips are central to the project, Barfield says, since the researchers' primary goal is to determine what percentage of sediment in the run-off from the "rain" is trapped by these strips.

"Our main purpose is to measure the impact of riparian vegetation on water quality," Barfield says, explaining that "riparian" means the natural vegetation along stream channels. The use of buffer strips is recommended by the U.S. Soil Conservation Service as a "Best Management Practice"—the best way to control erosion, or sediment yield, as well as agricultural chemical pollution. "Since the Soil Conservation Service is recommending the use of these strips, they want to know how effective they are—what percentage of the sediment and chemicals do they trap?"

And in trapping the sediment, Barfield points out, a "whole shopping list of chemicals" is also being

trapped. In measuring chemical levels as the sediment enters and then leaves the buffer strips, the researchers will be able to determine the effectiveness of the strips in keeping the chemicals out of the surface water.

Barfield emphasizes the point that this field work is truly a joint effort by the four UK researchers. Barfield is joined by Blevins and Evangelou, both professors of agronomy, and Carey, a hydrologist with the Kentucky Geological Survey and an adjunct professor in agricultural engineering. "We've divided up the responsibilities," Barfield says. "Basically my responsibility is to get the simulator working properly and coordinate the development of models to predict sediment trapping. Dr. Blevin is supervising the field work, Dr. Evangelou is doing the chemistry, and Dr. Carey is going to also work on the model development."

Once the researchers can predict how much run-off and sediment is coming from the field and how much is being taken up by the riparian vegetation, they plan to send these data to the Soil Conservation Service or some other regulatory authority for use in developing recommendations. The current project, funded by the Soil Conservation Service and under the USDA President's Initiative of Water Quality, began in July 1990.

"Based on the data we're getting now, we'll refine our experimental techniques and our models and do a full-scale evaluation next summer," Barfield says. ♦

continued from page 19

[the Garrett farm site is one of these] and are in the process of identifying through county agents several other sites," Taraba says. "We're hoping to start pulling samples from these areas in November."

Water samples will be collected frequently from each study area for at least two years. The total number of samples from each study area, according to Taraba, will be approximately 100. But a two-year period, he believes, may not be long enough to make an accurate assessment. "With work like this, three to five years is a more realistic time frame, since weather patterns need to be taken into account. In a year with a good growing season, nitrates are more effectively taken up from the soil—the plants use more of it. In bad years the nitrogen which is put on a field isn't taken up effectively and larger portions may enter the groundwater supply."

He says that the type of chemical used is also an important factor. Some chemicals sprayed on crops bind tightly to soil particles and don't move. Others are water soluble and move down with the water. "That's one of the things with nitrate. It's soluble in water and tends to prefer water over soil and will move with the water." Water samples taken will be analyzed by laboratories in the College of Agriculture and the Kentucky Geological Survey.

Taraba mentions that these various activities are currently being set in motion by the Core Planning Group for Senate Bill 271, which he chairs. "This is a ten-member committee made up of people in agricultural engineering, agronomy, entomology and forestry. Each of these college departments has faculty with the necessary expertise to contribute to this project. The research and extension faculty in the agronomy department are key individuals. Their knowledge of soils and crop production systems is vital and they are well respected by the agriculture community—a necessity for a successful program." Taraba says that the role of the committee is to recommend procedures and

“Dug and driven wells were 3.4 times more likely to show contamination than drilled wells. And shallow wells were 2.3 times more likely to have higher-than-desirable levels of nitrate.”

action to the dean of the College of Agriculture, Oran Little, who is responsible for implementing the program.

In their work, the committee has developed a collaboration with the Department of Geology, the Kentucky Geological Survey and IMMR [the Institute of Mining and Minerals Research]. Taraba is clearly pleased by this cooperative approach. "We wanted to bring in experts outside of our college because that ensures a more objective approach and strengthens the science of it," he says. "Through this collaboration, we can more adequately define the total water system in which we are working."

And this is crucial, Taraba says, when the college's extension agents take the information to farmers and to the public in the state. "They have to feel they can trust it. They want clear, concrete suggestions that they can use."

"It's this type of direct, face-to-face interaction that really fulfills our responsibility as a college in a land-grant institution," Taraba says. "One of our purposes historically has been to develop new approaches and technologies and transfer those back to the greater community."

"The College of Agriculture has always helped rural people find solutions to their problems, and this situation is no different," says dean Little. "We will provide our expertise so that people in Kentucky have a dependable, clean water supply." ♦

HONORABLE MENTION

In May of 1991, approximately 190 UK students with freshly earned doctoral degrees will begin to meet their professional goals. The professors who taught, challenged and nurtured them might have assumptions and hopes about which ones will soar higher than the rest, but predicting professional brilliance is a difficult task.

Is rising through the professional ranks the result of pure talent, or of talent mixed with timing and tenaciousness? Is opportunity more crucial than enthusiasm? How influential are academic mentors? Are the students who are hungriest for glittering careers most likely to achieve them?

Below, answers to these and other questions are touched upon in brief profiles of six UK doctoral graduates who have gone on to build outstanding careers.

by Suzanne Froelich



David Ott

David Ott, *Composer and Pulitzer Prize Nominee*

David Ott has experienced scores of musical triumphs since he earned his doctorate in music theory and composition in 1982. But his proudest moment came one heady night at the Kennedy Center in Washington, D.C.

"It was February 4, 1988, the opening night for my 'Concerto for Two Cellos,'" says the 43-year-old composer. "It was a dream come true, with the National Symphony Orchestra performing and Mstislav Rostropovich conducting. Afterward, Rostropovich brought me on the stage, gave me a hug, and I received a standing ovation that lasted almost five minutes. It was magical. I could have wept. It gave me a world of confidence."

"Two Cellos," which had been commissioned by the world-renowned Rostropovich, received a Pulitzer Prize nomination, as did two other Ott works: "Water Garden" in 1986 and "Piano Concerto in B Flat"

in 1983. "Always a bridesmaid," Ott quips of this remarkable distinction.

Over the past 10 years, Ott has written about 40 pieces, most of which are performed today by symphonies in large and small cities from Seattle to New York. "Two Cellos" alone is scheduled for 35 performances next year. "It's very gratifying," concedes Ott, who since 1982 has been at DePauw University, where he is composer-in-residence and associate professor of music.

Of his UK years, Ott best remembers the many professors who believed in him before the Pulitzer committee or Rostropovich ever heard of him. "All the (music) faculty were interested in me even though I was only another student at the time," he says, recalling with special fondness Nathaniel Patch, a now-retired piano teacher, "who gave me free lessons when I needed the help."

Much of what Ott dreamed of in those days has come true. What does he dream about these days?

To someday be financially secure enough to devote all his time to composing, he says. He would also like to draw more standing ovations with a piece now underway, a second commissioned work for Rostropovich titled "Concerto for Three Brass." He has yet to win the Pulitzer Prize, but then that's not a conscious goal of his anyway. Ott's No. 1 goal transcends money, applause and prizes. "What I really want to do is to write good music and then life will take its own course," he says. "Quality is what it is all about—to be creative and not to fall into a rut."

HONORABLE MENTION

Andreas R. Prindl, *International Banker*

When Andreas Prindl received his Ph.D. in international economics in 1964, he had modest goals: to be an assistant treasurer somewhere, earn more than \$25,000 a year, and get to Europe occasionally for vacations.

Today, Prindl is chairman of Nomura Bank International in London and a managing director of the European division of Nomura Securities Ltd., a Japanese financial firm with worldwide assets of \$40 billion. He lives in a former royal estate outside London, earns well over half a million dollars a year, and regularly jets around the world.

His success story is a dramatic case of being in the right places with the right interests at the right times, says Prindl, 51.

"When I joined Morgan Guaranty Trust Company of New York in 1964, they were interested in international expansion but didn't have many internationalists with languages on staff. I happened to speak German and French (languages always fascinated Prindl), so they sent me to Frankfurt and London." Then later they asked him to manage their bank in Tokyo, and that is where he got his job with Nomura.

"It was like riding a tidal wave—serendipity might be the word to describe my career," Prindl says.

A Lexington native, this international financier is the son of Frank Prindl, a former UK band director. After graduating from Henry Clay High School, Andreas went to Princeton University on a National Merit Scholarship and earned a

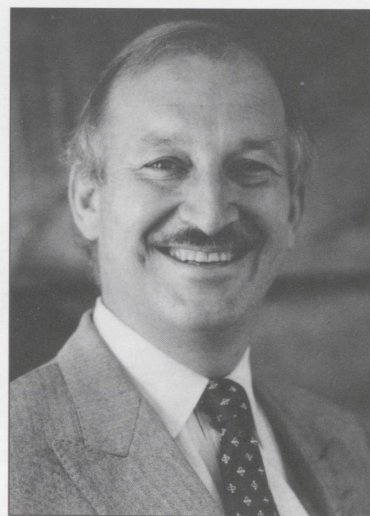
bachelor's degree in European languages.

He returned to Lexington to get his M.A. and Ph.D. in international economics at UK's Patterson School of Diplomacy and International Commerce, where he studied under Amry Vandenbosch, the first director of the Patterson School. "He was my mentor," Prindl says of Vandenbosch, who died in late October of this year at age 95. "He was an Albert Schweitzer type who guided my studies and served as a great moral force. He was a strict, fine man who had enormous intelligence and understanding of other peoples and other points of view."

Throughout his career, Prindl has always made time for university lecturing and writing. "I am proud to have been able to bridge the gap between business and academics, to some extent, by writing books helpful to both sides," he says. His 1976 book *Foreign Exchange Risk* has gone into numerous translations and printings.

Prindl, who was appointed to the Patterson School's board of advisors in 1983 and installed in UK's Hall of Distinguished Alumni last year, loves his periodic trips home to Lexington, to which he still feels a strong attachment. He has been successful beyond his wildest dreams, yet he would welcome an opportunity to have his career come full circle, geographically speaking, before the sun sets on it.

"Although it would be difficult to lure me away from England," he says, "I admit I would not mind ending up in an academic place. There is only one place I would go—UK."



Andreas Prindl

HONORABLE MENTION

William G. Crouthamel, *Leading Authority on Pharmaceutical Research*

As the first graduate of the pharmaceutical sciences doctoral program in 1971, William Crouthamel began his professional life with "a little claim to fame," he says. He took that distinction, ran with it, and in 1988 was named an outstanding alumnus by the UK Alumni Association for his stellar work in pharmaceutical research.

Always a thorough, hard worker who took no short cuts, Crouthamel fully expected his career would turn out just as it has: A steady upward spiral of solid scientific accomplishments, promotions, and increasing responsibilities.

After teaching stints at West Virginia University and the University of Maryland, Crouthamel was hired in 1978 as a group leader at Hoffmann-LaRoche Inc.'s U.S. research center in Nutley, New Jersey. He rapidly advanced to section head, assistant director, director and senior director. At Hoffmann-LaRoche, a Swiss-based pharmaceutical company with annual worldwide sales of \$4 billion, Crouthamel heads the drug metabolism department, which is responsible for evaluating new drugs through tests with animals and humans.

The 48-year-old Crouthamel, who has taken a leadership role in additional biopharmaceutical and phar-

macokinetic studies conducted by major professional associations, is considered a leading U.S. authority in his field.

Like most highly successful professionals, Crouthamel's horizons are continuously expanding. To gain an understanding of international drug research, he is presently on a one-year assignment for Hoffmann-LaRoche in Basel, Switzerland. "Companies today have a world market, whether they are selling cars or drugs," he says. "You have to make products that can sell anywhere."

As for the future, Crouthamel hopes to expand his managerial responsibilities and become more involved in the international aspect of pharmaceuticals. "What I have learned over the years is that the past is the chief indicator of the future," he says with confidence. "So I would guess I will continue to take on new challenges."



William Crouthamel

HONORABLE MENTION

Edward M. Coffman, *National Expert on Military History*

When Edward Coffman of Hopkinsville, Kentucky arrived at UK as a freshman in 1947, he felt like he was being introduced not only to college, but to a new world.

"I'll never forget my first concert at Memorial Hall," recalls Coffman. "A violinist named Tossy Spivakovsky performed; I was awed. We had concerts in Hopkinsville, but they were always high school bands. A few weeks later, when Spivakovsky was written up in *Time* magazine, I really had this sense of plugging into a much larger world than I had known before." (Spivakovsky was a violinist of some note who toured the U.S. during this time.)

Coffman, 61, went on to earn his M.A. and Ph.D. in history, and today is a professor at the University of Wisconsin, the author of several important books, and one of the nation's leading experts on U.S. military history. Perhaps a key to his success is that he approaches history with the same kind of enthusiasm he brought to UK in the '40s. "History has always been my hobby as well as my profession," he says. "I have always been fascinated by people who make history."

To Coffman, history *is* people. "In 1940, when I was in the fifth grade, I knew a Union veteran," he recalls. "He was 96. In 'Gone with the Wind' there is a scene where all the ammunition wagons blow up in Atlanta. Well, he saw that! That just blew my mind."

Throughout his career, Coffman has always attempted, when possible, to

talk to the history-makers about whom he teaches and writes. "I interviewed Douglas Campbell, the first American flying ace from World War I," he says. "I spent two hours with Douglas MacArthur in 1960. I talked with Omar Bradley in his office at the Pentagon in '61. Soon I'll be talking with a man who was a soldier in the 7th Cavalry in 1918."

Coffman has written several dozen papers and three major books, including *The War to End All Wars: The American Military Experience in World War I*, which is generally considered the best book on the subject. He is chairman of the U.S. Army's prestigious Historical Advisory Committee and he has been a visiting professor at the U.S. Military Academy, the Air Force Academy and the Army's Command and General Staff College. This year, he received a major award for his contributions to the field of military history from the American Military Institute.

He has been an historian, advisor and author, but of which distinction is he proudest? "My role as a teacher," he replies. "I have had some great doctoral students. Joe Glatthaar, author of *Forged in Battle: The Civil War Alliance of Black Soldiers and White Officers* (Free Press, 1989), was a student of mine. Another student, Jerry Cooper at Ohio State, has written many books. And a former student of mine is one of the top people in the military records section of the National Archives.

"Yes," he says, deeply satisfied to have so successfully passed on his love of history, "I'm very proud of my students."



Edward Coffman

HONORABLE MENTION

Paul Satz, *Head of the Largest Neuropsychology Program in the World*

When Paul Satz developed a riveting interest in neuropsychology while a doctoral student in clinical psychology almost three decades ago, it was a new and little-understood specialty. Today, the field, like Satz' career, is flourishing.

Neuropsychology—the study of the human brain and how it affects emotional states, cognitive functions and behavior—is one of the most rapidly developing specialties in the behavioral sciences today. And Satz is at the forefront as chief of the UCLA School of Medicine's neuropsychological program at the Neuropsychiatric Institute and Hospital.

Satz gained national attention early in his career when he won a coveted award from the Institutes of Research for his doctoral dissertation on a test detecting brain dysfunction in humans. After receiving his doctorate in 1963, he spent 16 years at the University of Florida, where he helped develop one of the nation's best programs in neuropsychology.

In 1981, he was chosen by UCLA to head its neuropsychology program, the largest and one of the best of its kind in the world. He is also a professor of medical psychology at UCLA and director of research for Camarillo

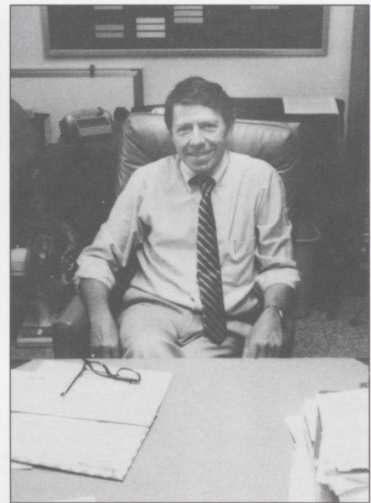
State Hospital/UCLA Research Facility.

Satz, who has written four books and more than 200 articles, travels abroad frequently as head of the World Health Organization's Global Project on AIDS. He is also involved in a dozen research projects, on topics ranging from depression to dyslexia, with former students and colleagues at numerous universities in the U.S. and abroad.

"I am a very prolific scientist," he says, "largely because of my students. I pick them carefully, collaborate with them, and grow with them. It has been an interesting model."

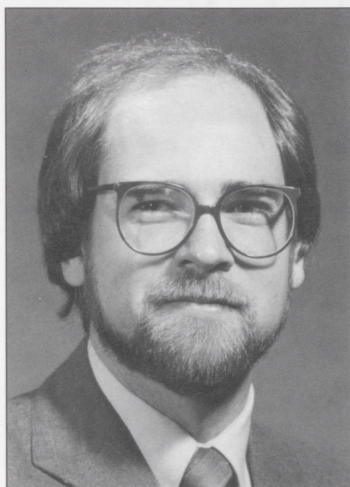
He is presently working on a brain-behavior relationships test that could be applied to illiterate populations in developing nations, where there is a clear-cut need for such testing. "That was the subject of my dissertation at UK," he notes, "and here I am, 27 years later, expanding on it."

Satz believes professional success is the result of talent, hard work, the ability to inspire others, enthusiasm and—last but hardly least—timing. "I was there on the ground floor (of neuropsychology) 25 years ago and so I just rode the crest," he says. "Sometimes you pick the right field at the right time."



Paul Satz

HONORABLE MENTION



Mark Davis

Mark E. Davis, *Internationally Acclaimed Chemical Engineer*

Mark Davis hit the ground running when he began his academic career as a UK freshman on a track scholarship in the early 1970s. Today he is still outdistancing the competition, but this time he's moving through the more cerebral field of chemical engineering research.

It is only nine years since Davis, 35, earned his doctorate in chemical engineering, but he has already garnered a number of prizes:

- A 1985 Presidential Young Investigator Award from the National Science Foundation, which designated him one of the best young researchers in the nation;
- The 1989 Donald Breck Award, a worldwide honor awarded every three or four years by the International Zeolite Association to the scientist achieving the most in zeolite research (Zeolites, the class of solid materials with which Davis works, are used to make gasoline and billions of dollars worth of other products);
- The 1989 Coburn Award, given by the American Institute of Chemical Engineers to the top chemical engineering researcher in the country under age 35.
- The National Science Foundation's 1989 Alan T. Waterman Award, a highly prestigious honor bestowed on an outstanding young researcher in science, mathematics or engineering. Davis is the first engineer to win the award, which brings with it \$500,000 for three years of research.

Davis, who has been on the faculty

of Virginia Polytechnic Institute and State University since leaving UK in 1981, will be moving to the California Institute of Technology next summer to become a full professor there and begin his Waterman-funded research on synthesizing new kinds of molecular sieves for possible applications in the pharmaceutical and biomedical fields.

Molecular sieves are now used to make petrochemicals; Davis' work may lead to their being employed to improve kidney dialysis treatment, produce environmentally safe pesticides and spark any number of technical advances.

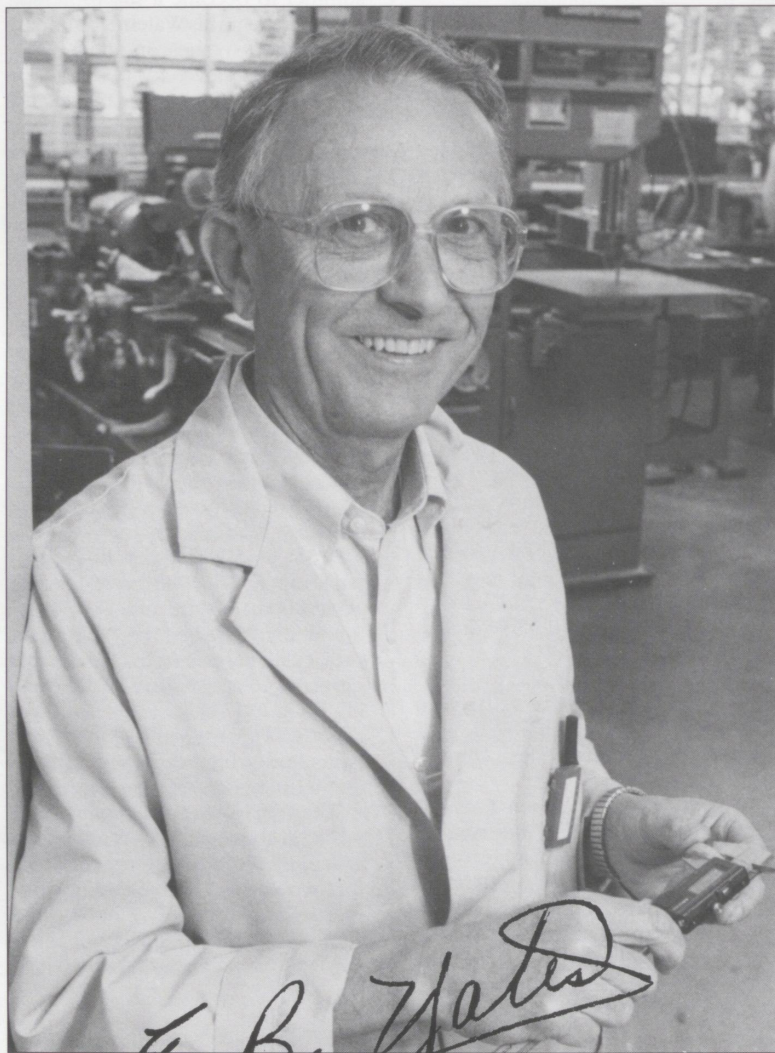
"We are not creating new products," explains Davis. "We are creating new materials that can produce key (chemical) reactions and new fundamental ways of doing things. Once we have proven the concept, others can take the concept and go on to create the specific products that are needed."

Davis, whose work has been written about in *The Wall Street Journal*, *Washington Post* and other major national media, says the Waterman project is only one of five he and his group of 10 assistants will be working on at Cal Tech.

With so many awards and accolades under his belt, does he have any unmet goals left?

"So often in academic settings you work on concepts," Davis reflects. "I would like to create a new material that would lead to something commercial, to say, 'OK, I have done something to help society.' I think that is a reasonable goal, don't you?" ♦

BEHIND THE SCENES



E.B. Yates

For "Tinkerer" E.B. Yates, Building Another Machine Is Just Routine

by Suzanne Froelich

His name is on no research papers and he has won no awards. Yet technician Elijah ("E.B.") Yates has been a key figure in the millions of dollars worth of research projects conducted by the College of Engineering's Department of Mechanical Engineering over the past 40 years.

Yates, a slight, soft-spoken technician who will retire this January after 39 years at UK, is a little embarrassed at being interviewed, claiming "there's not much to tell about me." But department chairman A. F. Seybert is happy to speak up about this valuable part of his team.

"E. B. Yates doesn't get any public recognition, but he has been literally the man behind the scenes in our research projects. He has designed, built and tested all of the experimental apparatuses we use in our research programs. "And he is extremely flexible," Seybert says. "He often gets back-of-the-envelope type sketches from professors and he is able to translate that into working apparatuses."

Taking a visitor through a half-dozen research labs in Anderson Hall, Yates points out numerous examples of the one-of-a-kind machines he has designed (working from professors' and students' ideas), built and maintained over the years. Among them:

- In the nuclear lab, a foil-wrapped sodium loop, made from pipes welded together, is used to pump liquid

BEHIND THE SCENES

sodium around and around in tests designed to study sodium as a possible cooling agent for use in space shuttles;

- On a "flame-spreader" in the combustion lab, paper is fed by cranks along a device that looks like miniature monkey bars and is burned so that researchers can measure how long it takes a flame to split. The results of this research also may benefit the space program;

- In the multi-phase flow lab, a tube-and-pump contraption is used to study the flow of water and particles in a centrifugal pump so that researchers can determine how to run a pump with minimal pipe erosion. Success on this project could save corporations millions of dollars.

Although he refers visitors to the professors for more detailed explanations of these and other projects, Yates knows "a little bit about everything" that goes on in the labs.

Asked how many machines he builds in a year, Yates smiles. "With all these different labs (there are 10 including the undergraduate lab, which Yates also maintains), we are building something all the time."

His career at UK has been immensely more varied and integral to the work of the department than anything Yates, 65, could have envisioned when he was hired to work in the department's machine shop 39 years ago. "I never thought I had the education to do this," he says. "But I work with a dozen Ph.D.s every day and I've picked up things from each one of them. If I have a problem, I go to the professor in that field and pick his brain, and he helps me out. That's how I've gotten by."

Yates also attributes his successful career in research technology to keeping up with technical journals, learning everything he can about new machines coming into the labs,

and being willing and able to advance with the ever-changing technology.

A Harrodsburg native who attended McAfee High School in Mercer County, Yates always loved to tinker with machines. After a two-year stint in the Navy, during which he did maintenance work on planes, he spent another couple of years in a tool-and-die apprenticeship in Lexington. In 1951, a friend told him UK was looking for a machinist to work in mechanical engineering and Yates got the job.

Since then, mechanical engineering has become "a wide open field," says Yates. "When I started we were dealing more with mechanical things and making calculations on slide rules. Now the instruments are more electronic, calculations are done automatically with sophisticated machines, and professors have different specializations—combustion, nuclear, robotics . . . I never thought when I came here, for example, I would someday have a computer on my desk, but I use one now for making drawings of machines."

In the early '70s, Yates moved to the research labs in Anderson Hall, where he currently works with one other technician, Sylvan Ferrell, who specializes in electrical projects. It was a transfer Yates welcomed because it meant infinitely varied work. "My job is constantly changing," he says, "because each year we have new professors, new students, new ideas, new machines . . . new problems."

With the help of a student assistant, Yates does his building in a machine shop equipped with lathes, saws, drill presses, sanders, grinders and two milling machines that can measure metal to .0005 of an inch before slicing through it.

His career in research has also meant daily contact with students, which Yates has found to be a demanding but energizing and deeply satisfying aspect of his work. "I get interrupted a hundred times a day by students wanting to know how to do this or that. I help them when they need help and I make them do what they can do on their own. I am not a teacher but close to it."

What have been the high points of his long career?

Yates immediately recalls the fall of 1969 when UK's mechanical engineering department was one of 142 analysis teams across the country to receive samples of moon soil after Neil Armstrong's historic lunar walk. [see related article, "From Meteroties to Dendrites," p. 6.] "The publicity was so high—we even had to install a special security system on the doors. We built a lot of vacuum systems for that project . . . I held that moon dust right in my hands," he says, holding

continued on page 30

“ I never thought I had the education to do this. But I work with a dozen Ph.D.s every day and I've picked up things from each one of them. ”

“My job is constantly changing because each year we have new professors, new students, new ideas, new machines . . . new problems.”

out his hands and savoring the memory.

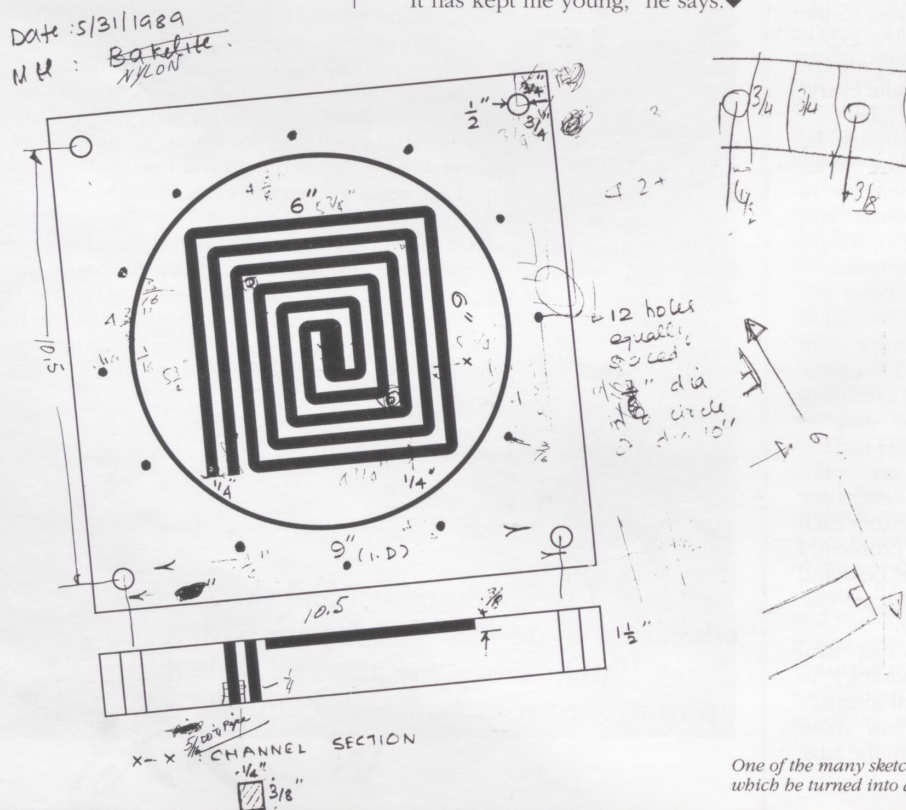
There were low points too. “Sometimes, they ask the impossible,” says Yates, who was once asked by the medical center to witness a heart-lung operation and then design a device that would hold catheters in place in the patient’s chest cavity while surgeons worked. (This was in the days before the heart-lung machine, which does that job today.)

Yates, who had had no experience in medical devices, not only failed to come up with a solution but turned green and almost passed out during the operation. That was one of those times he had to say, “Sorry, I can’t.”

Far more often, Yates has come up with the right answer, says Seybert. “Everyone in this department can think of a dozen times when he has come through in a pinch. My biggest nightmare as chairman has been the prospect of replacing him. If we can find someone to do only 60 percent of what E. B. does, we will be happy.”

Yates is looking forward to spending his retirement tending the greenhouses on his son’s 50-acre farm and spending more time with his three-year-old grandson. But he will miss many things about his career at UK—the variety, the energy, the kick of converting a professor’s wild idea into a workable machine, the satisfaction of helping students who may someday go on to publish important research papers and win awards.

“It has kept me young,” he says. ♦



Getting the Lead Out of Rural Economies: Kentucky Lumber Industry to Begin Pushing Pencils?

Changes in the world timber market could be a boon for rural Kentucky economies. Increased concern about deforestation and the preservation of rainforests worldwide will soon create an increased market for Kentucky hardwoods, according to Joseph Chang and James Ringe of the University of Kentucky's Department of Forestry. And if sawmill owners are willing to make a few changes, more jobs and more money will be added directly to local economies, where an economic boost is most needed.

"Most of the economic development in Kentucky has happened in the 'Golden Triangle' between Louisville, Lexington, and Northern Kentucky," says Chang. "What we're hoping to do is to bring the existing sawmill industry one step beyond what they have been doing by using value-added production to create local employment."

Value-added production involves processing wood beyond the lumber stage so that it is worth more before it is exported (Kentucky wood has traditionally left the state as raw lumber). Ringe explains, "If I sell you a log, you pay x-amount. If I cut lumber from it, you pay more. If I make something out of it, you pay even more. I don't want my wood leaving the state until I've gotten you to the point where you're paying me as much as possible, because then that money stays in the state."

"The upshot of all this," Chang ex-

plains, "is really trying to develop a coherent strategy for rural economic development." Ringe and Chang believe that existing industry in Kentucky could adapt to value-added production very easily. "In most of these rural communities the sawmill is already in place," says Ringe. "There is no need to bring in outside industry."

If local sawmill companies will process the wood further, Ringe and Chang point out that this will also increase the number of jobs in that community. "It may only add 5, 10, 20 jobs," admits Chang, "but in most of these small rural communities, 20 jobs is a major increase." In addition, these jobs would not require much training, would not invite outside competition, and would be an economic shot in the arm to the local community.

Pencil slat production is one example of this value-added production. "We wanted to see if we could produce pencils from low-grade Kentucky yellow poplar lumber," Ringe says. "Pencil slats are the strips of wood pencils are made from. They put lead in between the slats, glue them together, and then cut separate pencils out of that." The results of their test have made them optimistic about the ability of rural sawmills to produce yellow poplar pencil slats in the near future; they are easy to cut and would not require much re-tooling or training, and the wood makes a high-quality pencil.

Chang and Ringe are quite pleased with the in-kind support that the wood industries have given them. "We supplied the industry with the wood, and they made the pencils for us free of charge. We wanted to see the quality of the pencils, and they wanted to see how the yellow poplar would go through the equipment, so

it worked out quite well."

Another value-added strategy Ringe and Chang are exploring is cutting dimension stock, or cut-to-size furniture parts, from Kentucky lumber. They also hope to market Kentucky wood overseas. In the United States, wood must be a certain size to bring a top price. Smaller pieces of wood which are unblemished are worth more in foreign markets than they are in the U.S.

Ringe and Chang have received considerable interest, too, from the wood products industries in other Appalachian states. "They're very interested in this sort of thing as well," says Ringe, "because their industry, their timber, and their job situations are much the same as ours."



Students Choose Research over R&R

During the summer of 1990, seven undergraduates participated in the Graduate Center for Toxicology's second Undergraduate Summer Research Experience at the University of Kentucky. The students represented diverse cultural and ethnic backgrounds and came from colleges all over the country to be a part of the program. They helped conduct research on topics ranging from DNA modifications to the effects of phenobarbital on the liver. Through interacting with professional researchers and with each other, they learned about the research environment.

According to Thomas Tobin, "It was very clear that they enjoyed their experience at UK and had good interactions as a group." The students were paired with professors to advise them and aid them in their work. At the end of the program, students prepared and presented papers on the research they took part in.

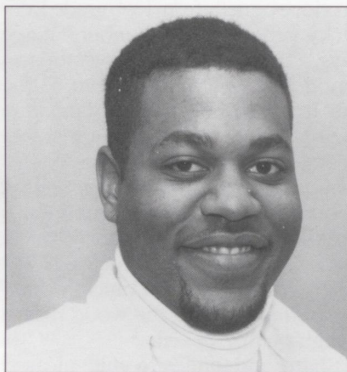
The Research Experience Program was begun by Tobin in 1989. An ad campaign was developed to promote the venture, and students were selected through telephone interviews. Kevin Thomas, a student from UK, said he found out about the program through a friend of his aunt's. His research project involved studying four spots on DNA extracted from broccoli. "We were trying to see if these spots could be used to slow down carcinogens in humans," says Thomas, a chemistry-biology major. He adds that he feels the program is valuable because it offers students a chance to "work with people from all over." He plans to keep in touch with the other students who participated.

The program is open to any interested undergraduate with a 2.5 GPA or higher, and three of the spaces in the program are reserved for minority stu-

dents. Tobin feels a strong commitment to the minority aspect of the Research Experience. "Minority programs are extremely important to the University of Kentucky," he says. He adds that he would like to expand the program, "to bring a higher percentage of minority students into toxicology, especially American Indians and students of Hispanic origin." Tobin says he feels these minority groups in particular are "extremely underrepresented assets." This past summer, four minority students participated in the program.

This year's participants were Hanan Abdul-Rahim, of Salem College; Rocio Pasion, from the University of Rhode Island; Roxanne Smith, from Alcorn State University; Kristina Braunlich of Pacific Lutheran College; Kevin Thomas, a student at the University of Kentucky; Greg Carlsen, from Idaho State University; and James Parkerson, from Centre College in Danville.

—Melinda Higgins



Kevin Thomas, who participated in the Undergraduate Research Experience at UK last summer, hopes to graduate with a double major in chemistry and biology in the spring of 1992.

Analyzing the Faces of Alzheimer's

By the year 2050, according to a recent National Institute on Aging study, 14 million people in this country will be victims of Alzheimer's disease. The prospect of a growing Alzheimer's "epidemic" has led to the tremendous push in clinical Alzheimer's disease research across the nation to find causes, treatments and possible cures.

So far, though, says Deborah Danner, a senior research associate at the UK Sanders-Brown Center on Aging, there has not been a great deal of social science research conducted with the victims of Alzheimer's disease. Danner, a doctoral student at UK in educational psychology, is collaborating with William Markesbery, professor of neurology, and David Wekstein, professor of physiology, on a study of how to read the emotional states of Alzheimer's disease patients by observing their facial expressions. "As the stages of Alzheimer's disease progress and patients lose their higher-level cognitive and communicative capabilities, they may still be able to express their emotional states facially and behaviorally," Danner says.

Danner videotaped 30 hours of voluntary and involuntary facial behavior of three patients with a diagnosis of probable Alzheimer's disease at three levels of cognitive decline. Universal expressions of happiness, sadness, anger, fear, surprise and disgust were observed and evalu-

ated through a series of criteria. Also investigated were expressions of pain, anxiety, fatigue and boredom.

The system used for evaluating facial be-



havior is the Facial Action Coding System (FACS). This system was developed by Paul Ekman and Wallace Friesen of the University of California at San Francisco, who consulted with Danner in this pilot study. Her study is the first to use FACS to evaluate facial behavior in Alzheimer's disease patients. In addition to having their involuntary facial expressions videotaped, the patients were asked to voluntarily produce a given expression—happiness, sadness, anger, fear, surprise and disgust—and were evaluated on their ability to do so.

What Danner found in the pilot study is that it is possible to observe and evaluate facially expressed emotions of these demented patients by using an objective system.

Results of this preliminary study suggest that as the dementia progresses and patients lose cognitive function, the ability to express emotions voluntarily decreases: patients are not able to "mask or fake an emotion, abilities which require voluntary control, because these abilities call for higher-level cognitive skills than involuntary facial expression," Danner says.

During the videotaping, the three patients expressed emotions that appeared appropriate to the particular situation. However, the two more demented patients appeared to lose some of the facial subtleties of the emotion. "There was not as much range of expressions for the two most

impaired subjects; however, the intensity of the emotions which these individuals expressed



was strong," Danner says. The least impaired patient expressed happiness, sadness, fear, surprise and disgust. The moderately impaired patient expressed only happiness and disgust, while the most impaired patient expressed only happiness and sadness.

Being able to gain information from a patient who must rely on non-verbal communication is the aim of this research, Danner says. "This system may provide a window for interpreting how individuals are feeling. Though they can't tell us, their faces may be telling us," Danner says.

Results of this work may give caregivers and others involved with Alzheimer's disease a means to communicate more effectively with patients. "The strength of future research in this area is that as soon as the findings are available, we can start doing things to improve care," Danner says.

Additional studies will be conducted over the next three years to look more closely at the relationship between disease severity and the patient's ability to express and understand facial emotions. Financial support for the pilot project has been provided by the Alzheimer's Disease Research Center at the University of Kentucky Sanders-Brown Center on Aging and the Lexington/Bluegrass chapter of the Alzheimer's Association.

—C. Teresa Arnold

Dissertation-Year Fellowships

The Dissertation-Year Fellowships were created in 1988 to encourage and support research by doctoral students at the University of Kentucky. Money was allocated for 12 annual fellowships of \$10,000, with recipients eligible to apply for an extra \$1000 grant to pay for related dissertation costs. The fellowships were intended to encourage research in all fields of endeavor, and each year's list reflects the diversity of research ongoing at UK.

This year's fellows represent a broad cross section of the university, from the liberal arts to the hard sciences.

Rong Guang Linn, a doctoral candidate in chemistry, is using his fellowship to learn about electron transfer in molecules. He hopes to be able to design molecules which will transfer electrons quickly enough to store energy from sunlight. Such capability would make solar power a viable alternative energy source.

Biology student Terry Newcomb is a doctoral candidate working at the Dorothy Enslow Combs Cancer Research Center at UK. She received a fellowship to fund her research on calcium regulation in normal and cancerous cells. "The good thing about it," Newcomb says, "is that it allows me to concentrate on my own research without having to divert my attention to other things to support the project."

Andy McIntire received his fellowship to aid his study of the Viet Nam war and the men who fought it. His dissertation will document the experiences of soldiers in the Viet Nam conflict.

Other recipients of the Dissertation-Year Fellowships for 1990-91

continued on page 34

are Zhi-Qiang An, plant pathology; Theodore Gentry, music; John Speer, political science; Joel Kailing, communications; Arun Basu, mining engineering; Christine Kern, medical microbiology; Pinchieh Pai, civil engineering; Prasad Pai, chemical engineering; and Demetrio Zourarakis, agronomy.

The fellowships are competitive, and doctoral candidates must be nominated by an advisor in their department. Recipients must be in residence at the University of Kentucky, and engaged in research on a full-time basis for the duration of the fellowship.

—Melinda Higgins

Davenport Awarded MacArthur Fellowship

This past summer, Guy Davenport became the first University of Kentucky faculty member to receive a MacArthur Foundation Fellowship. The English professor, author and painter was awarded \$365,000 to pursue his creative interests. He joins a select group of 319 persons to be honored by the Foundation since its inception.

The MacArthur Fellowships were established in 1978 to give creative people a chance to pursue their interests free of the burden of having to earn a living. Recipients are nominated and selected secretly, and the five-year fellowships are granted without restraints. MacArthur fellows are free to use the money they receive as they see fit.

Davenport has taught courses in comparative literature, poetry, and British literature at UK for 27 years. Over that period of time he has pro-

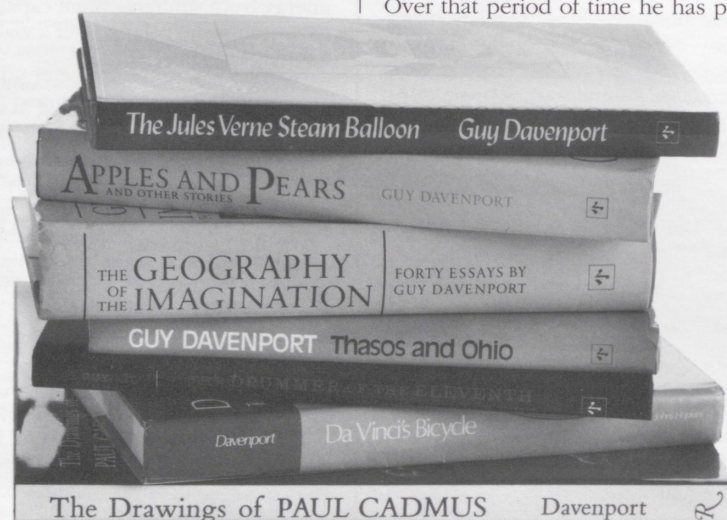
duced an impressive number of books, including several Greek translations and collections of short stories, all of which are still in print. His most recent collection of stories, *The Drummer of the 11th North Devonshire Fusiliers*, is the last in a trilogy about an imaginary Danish school.

"After I wrote the first two books in this series, I thought I would go and look at Denmark—I had never been there—and boy, did I get everything wrong!" Nonetheless, the stories hold up. "All my stories are about things I scarcely know anything about," laughs Davenport; "that's the fun of writing them."

Davenport initially began writing fiction as a hobby. "It's a wonderful puzzle," he says, "what happens when your hobby becomes your business." Davenport remains humble about his success as a writer. He says that while he doesn't like to think about himself at all, when he does, he considers himself to be a teacher first. Davenport is also an amateur painter and hopes the MacArthur grant will allow him more time to pursue this interest. "Painting has always been my way of relaxing."

Aside from taking next year off "to do something in the spirit of the MacArthur Fellowships," Davenport says he is superstitious when it comes to talking about things he plans to do. "I may travel; I've got the means now. And I do hope I'll continue to write more fiction." ♦

—Melinda Higgins



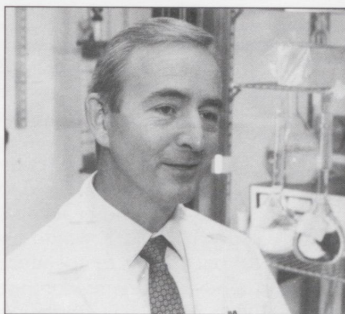
UPDATE

Peter Oeltgen: UK's HIT Man

Peter Oeltgen rarely tires of talking about sleep. His primary interest, more specifically, is the phenomenon of hibernation in animals, his research focus since the late 1970s. One of only a handful of scientists worldwide studying the biochemical basis for hibernation in animals, Oeltgen, an associate professor of pathology, is credited with naming the substance which causes hibernation: HIT—the Hibernation Induction Trigger.

Once the chemical identity of HIT is discovered, Oeltgen says, a host of clinical applications could follow. Organ preservation and transplantation could become routine as could cryosurgery (lowering body temperature so that the heart beats more slowly), and insomnia and obesity could be cured. Although he indulges in pondering a future that includes these breakthroughs, his research is bent on laying the scientific foundation for such possibilities, not creating them.

"The key is to identify HIT chemically," says Oeltgen, and for the past 12 years he has worked extensively at the biochemical level on a topic that for centuries has been documented only through direct observation of hibernating animals. Building on a 1968 study by two Loyola University researchers that proved hibernation is set off by a chemical present in the hibernator's blood, Oeltgen further



Peter Oeltgen

defined HIT by tracking it to the blood protein albumin.

He currently isolates HIT fractions from the blood plasma of woodchucks. "Woodchucks are our primary source of HIT because they are convenient models—as compared to ground squirrels or even black bears—and are readily available," he says. "We purify the albumin in the plasma, in effect isolating the HIT, which is tightly bound to the albumin carrier molecules." The fractions are then reduced to a dry, white powder form, which can be put into solution as needed for injection into test subjects.

Oeltgen defines the mysterious HIT as "a small neuropeptide hormone of brain origin," yet grimaces at the inadequacy of the wording. "It will take more collaboration to do the protein and peptide tests needed to characterize HIT at the molecular level, but for now progress is relatively slow," he says.

Oeltgen estimates that from 150 to 200 scientists are studying hibernation worldwide, yet less than a dozen are actually pursuing the molecular identity of HIT. Of these, Oeltgen

notes the work of James Skinner, a neurophysiologist at Baylor University, who has researched the biochemical complexities of HIT, finding that it inhibits urea excretions and causes antihypertensive activity in rats. In addition, scientists at the University of Colorado are examining HIT from a biogenetic viewpoint in an effort to discover a common protein ancestor for the trigger.

UK Collaboration

Funded by the U.S. Department of Defense since 1987, Oeltgen has wisely piggybacked his research onto the projects of several colleagues at the University of Kentucky. The mutually beneficial studies have led to remarkable developments in both HIT characterization and organ preservation.

Perhaps the most notable is Oeltgen's collaboration with Sufan Chien, assistant research professor in the UK Department of Surgery, on extending organ life. "Neither of us knew one another," recounts Oeltgen, "but Dr. Marcus Dillon, a UK thoracic surgeon, knew about my work with HIT and thought it might be helpful to Dr. Chien's work, trying to keep organs alive longer for use in transplants."

Because animals in the hibernating state exhibit marked drops in metabolism, heart rate, oxygen consumption and body temperature—all without damage to their organs—using the trigger to keep fragile transplant-bound organs alive longer seemed a natural application.

Chien had already improved organ life in his own research on a canine multi-organ preservation system, in

Oeltgen's hibernation research was featured in the Spring 1985 issue of ODYSSEY.

continued on page 36

which groups of organs—the heart, lungs, liver, kidneys, pancreas and part of the small intestine—are removed together, still linked by blood vessels, and floated in a tub containing a balanced solution of salts and minerals to minimize physiological stress. Hooked to a mechanical respirator, the lungs provide the organs' tissues with oxygen. With all other vessels tied off, the system forms a closed loop, operating normally with only a body and brain missing to make it complete.

"In early tests, we had difficulties with the liver becoming congested," explains Chien. "Originally, we wanted to use HIT just to reduce the liver congestion, but then I thought its potential as a metabolic inhibitor might be useful in extending the organs' survival time."

Chien was right on both counts. After injecting HIT into a set of canine organs, the researchers saw survival time jump three-fold, to a remarkable 56 hours. HIT also seemed to reduce the deterioration of the liver, kidneys and red blood cells that had hindered earlier experiments.

Further tests corroborated the initial success. Not only did the organs continue to survive in the salt-and-mineral solution bath longer than any recorded survival time in the United States (with researchers using similar techniques), they also stayed in good shape after transplantation.

Future Applications

Oeltgen notes other possible applications for HIT. "The potential for using HIT in cryosurgical procedures is quite good," he explains. "For example, in open-heart surgery, body temperature can now be lowered to around 72 F to slow the heart rate. Putting it down to 40 F would be preferable, but at that temperature the heart tends to fibrillate [contract irregularly]. With HIT, fibrillation might be prevented because HIT acts to maintain the electrical balance of the heart, just as it does for animals as they hibernate."

The same effect would also be beneficial in cases of severe head trauma. HIT would allow the body to be cooled without heart fibrillation and prevent the deadly nitrogen imbalance which occurs in such victims. "All kinds of trauma, microvascular disease, tissue preservation and even the prevention of multi-organ system failure could potentially be treated by HIT," says Oeltgen.

Although the potential clinical applications of HIT continue to dazzle scientists—the treatment of cancer and heart disease have also been mentioned—Oeltgen keeps both feet firmly planted in reality.

"All of the clinical applications are not out of the question," he says carefully. "But the research necessary to develop them is only possible if we can identify HIT." ♦

—Leigh Gaines

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