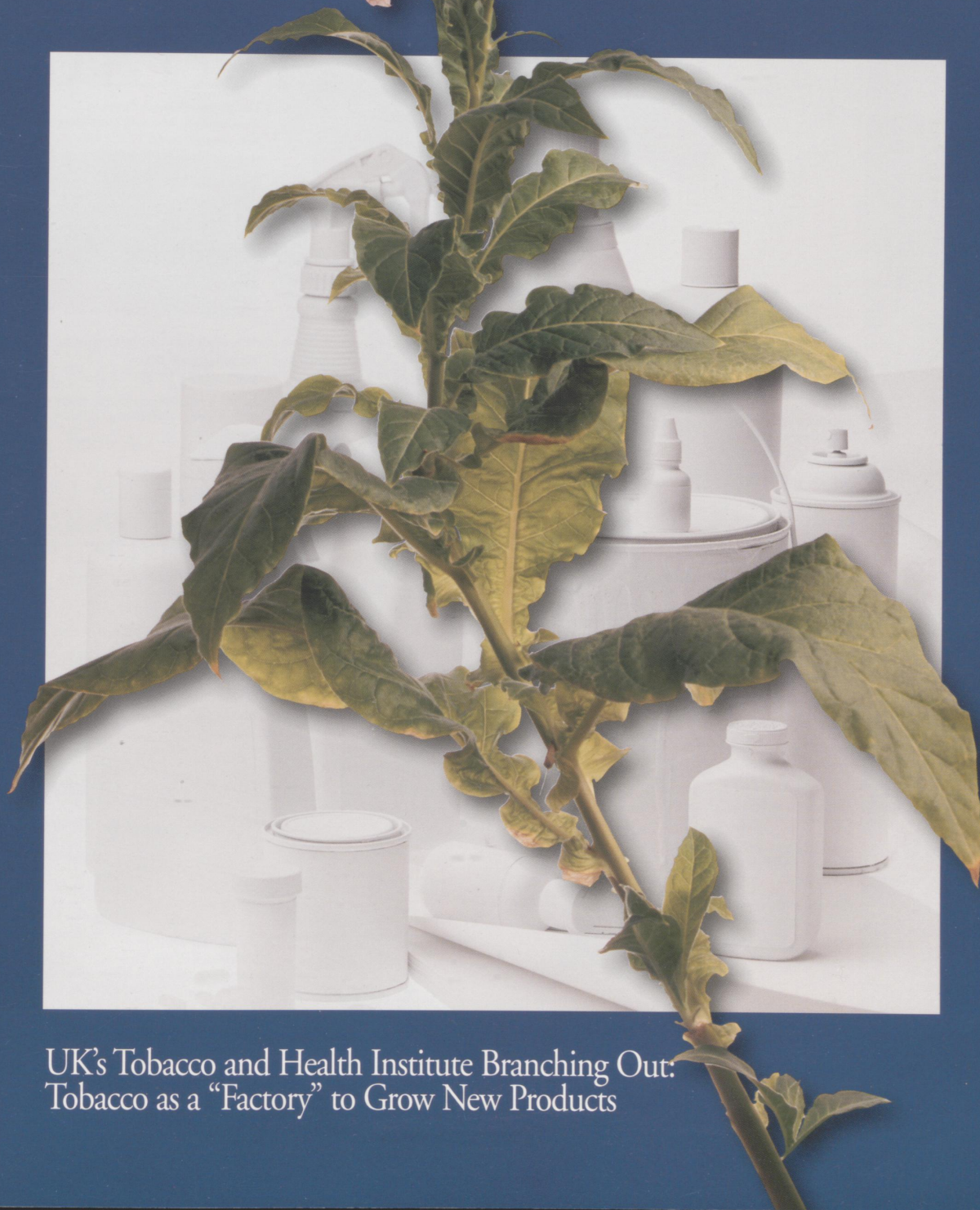


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ODYSSEY



UK's Tobacco and Health Institute Branching Out:
Tobacco as a "Factory" to Grow New Products

RESEARCH

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UK RESEARCHERS SURGING
AHEAD WITH HIGH-SPEED COMPUTER
NETWORKS, p.12



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Dear Friends of UK,

It is with a great deal of optimism and enthusiasm that I take this opportunity to write to you on the work of our Research and Graduate Education (RGE) Task Force. Last May higher education reform in Kentucky resulted in legislation known as House Bill 1 that set goals to be achieved by the year 2020. One goal is for the University of Kentucky to be ranked among the top 20 public research universities in the country.

Our current national standing of 45th out of the top 100 public institutions as measured by research expenditures, combined with the new state commitment for funding research and graduate education, positions us well to move toward this goal.

The RGE Task Force, under the leadership of Dr. Dan Reedy, former dean of The Graduate School, was appointed to make recommendations on strategic priority areas for investment. Every university group from chancellors, deans and faculty to students and administrators provided ideas for the improvement of research and graduate education. Each academic and research unit across campus submitted program reports that were analyzed on several levels by the task force.

The following distinguished, nationally competitive programs have emerged as targets of opportunity toward achieving top 20 status: Aging & Gerontology, Agronomy, Anatomy & Neurobiology, Biochemistry, Chemistry, Chemical & Materials Engineering, English, Geography, History, Mathematics, Microbiology & Immunology, Pharmaceutical Sciences, Physics & Astronomy, Physiology, Psychology, Public Policy & Administration, Spanish, Special Education, Toxicology, and Veterinary Science. Another 13 programs have been identified as positioned to achieve national stature.

The task force has also made recommendations for strengthening our research infrastructure and for increasing student and faculty graduate education support.

The final report of the RGE Task Force has been issued, and we are in the process of reviewing it for incorporation into the university's Strategic Plan. As we continue to build on our solid base of research excellence, we ask for your continued partnership and support. Together we will achieve our mission for research and graduate education at the University of Kentucky: Challenging the Future, Changing Lives.

Yours truly,

Fitzgerald B. Bramwell



UK'S TOBACCO AND HEALTH INSTITUTE BRANCHING OUT:

Tobacco as a "Factory" to Grow New Products

There's a new breed of researcher at UK's Tobacco and Health Research Institute (THRI) who might also be thought of as a factory worker. The "factory," in this case, is the tobacco plant.

Researchers in recent years have found that tobacco's large green leaves can be an incredibly prolific seedbed, a kind of super-rich petri dish in which to produce everything from antibiotics to sugars to industrial enzymes — even anticancer and AIDS-fighting compounds. "Because its genes and biology are so easily manipulated, tobacco is probably the best white rat in the plant kingdom," says Glenn Collins, UK professor of agronomy, who adds that because tobacco has been the primary plant of choice for genetic bioengineering for a number of years now, there's a large data bank from which to draw information about the plant's genetic structure and its potential for being manipulated genetically.

"In the past year and a half, THRI has undertaken a major refocus of its mission," says Maelor Davies, director of the institute. "We now have in place a comprehensive plant biotechnology program whose goal is to help develop new products based on transgenic tobacco. The purpose is two-fold: to explore the use and potential of genetic engineering to create new crop opportunities for farmers, and to seek industrial partners who will collaborate with the institute to grow useful new products in the tobacco plant."

This new commercial mission of the



Photo by Bill Meener

institute follows two decades of work in which THRI was devoted almost entirely to tobacco-related medical research. This previous pure-science mission focused on *how* tobacco use causes diseases. Projects ranged from work on the effects of tobacco on the human cardiovascular and pulmonary systems, to the effects of environmental smoke and the relationship between smoking and other diseases. "THRI isn't moving totally away from delving into health-related issues, not at all," says Davies. "But presently two-thirds of our efforts are targeted to transgenic tobacco."

This shift of focus to developing new

crop possibilities for farmers should be good news for Kentucky, where the farm economy has historically been so dependent on tobacco. Primarily because of growing public awareness of the dangers of smoking, the long-term economic potential for tobacco production remains cloudy, and in recent years there has been considerable interest in developing new crops for Kentucky farmers.

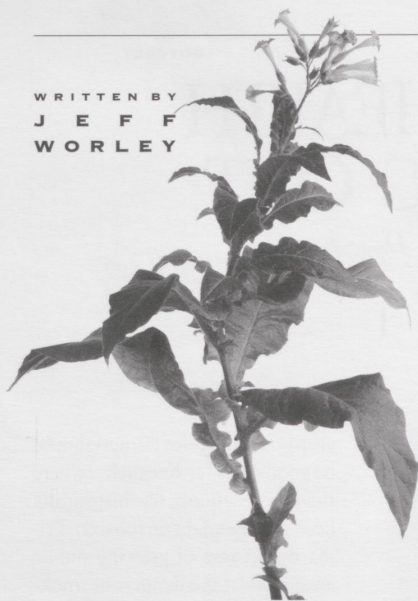
"New crops imply change, and few people like fundamental change because it creates uncertainty," says Orlando Chambers, a newly hired agricultural economist in THRI's Tobacco Biotechnology Group. "Farmers like the crops they know how to produce and which are adapted to their soils and their machinery. Many of Kentucky's small family farms have survived largely because of the nature of tobacco production. The small acreage requirements and the large potential profits make finding alternatives to tobacco very difficult."

There have been several enterprises suggested to farmers as a way to buffer any declines in tobacco income, for example, vegetable production. There have been some successes with alternative crop-growing, but a tobacco farmer who suddenly goes into the tomato business takes a risk that there might not be much of a need for this crop locally, or that the market is overly competitive.

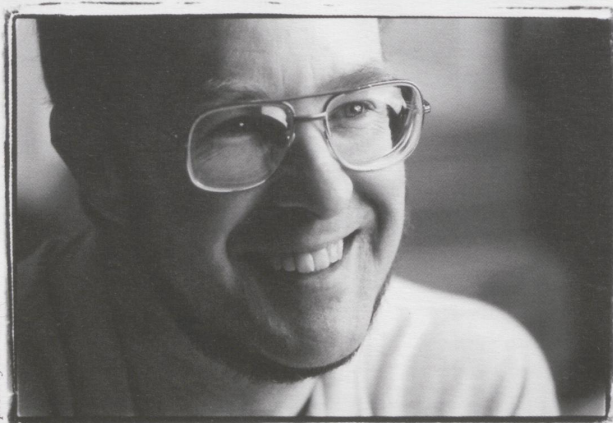
"A major point we need to emphasize is that we're not talking about new plants as much as new markets," says Davies. "What we're really trying to do for the tobacco farmer is to help develop a new commercial

continued on page 4

WRITTEN BY
J E F F
W O R L E Y



"I believe this will be a snowballing kind of thing; the more companies that we can form partnerships with—and who realize the benefits of such a partnership—the more will jump on the bandwagon."



THRI DIRECTOR MAELOR DAVIES: "THRI ISN'T MOVING TOTALLY AWAY FROM DELVING INTO HEALTH-RELATED ISSUES, NOT AT ALL. BUT PRESENTLY TWO-THIRDS OF OUR EFFORTS ARE TARGETED TO TRANSGENIC TOBACCO."

opportunity." Here is the scenario Davies envisions: companies that want certain products will contract with farmers to grow a specified acreage of transgenic tobacco. This way, the farmer will have another unique market to call his own.

There are sound reasons for developing new crops based on transgenic tobacco, according to Chambers. Tobacco produces a large amount of biomass per acre (some experimental methods have produced as much as 90 tons per acre), it is easy to engineer, and it is well suited to growing conditions in Kentucky. "It's important to note that we're not suggesting to farmers that they quit growing their traditional crops and gamble on transgenic crops; we're suggesting that farmers might want to consider growing some acres of transgenic tobacco as an additional potential income source," Davies explains.

These secondary crops would add to the already-impressive amount of tobacco Kentucky produces. Tobacco is the state's No. 1 cash crop, and Kentucky is second only to North Carolina in tobacco production. In Kentucky the crop is grown by 67,000 farmers in 119 of 120 counties, from the western plains to the steep hillsides in the Appalachians. Tobacco accounts for 25 percent of total farm sales in Kentucky.

Laying the Groundwork at UK for Tobacco Biotechnology

"Here in the College of Ag, we started thinking in the early '80s about harnessing the tools of genetic engineering," says Collins, who is currently marking his 31st year at UK. "Now, as far as putting foreign genes into a tobacco plant using newfound recombinant DNA, we already have a very solid knowledge base."

Collins says a recent major event was an international symposium on plant engineering held at UK on October 1-4, 1995. John Diana, former director of THRI, and the THRI board of directors committed resources to sponsor this symposium with the specific focus of engineering plants for possible commercial products and applications.

"This gathering was tremendously important, a huge success," Collins recalls. "We focused on five topical areas and attracted 425 participants from 23 countries. This was the first symposium ever held specifically devoted to engineering plants to make commercial products."

One result of this conference was the publication of a special issue in the *Annals of the New York Academy of Sciences* titled *Engineering Plants for Commercial Products and Applications*. The book, edited by Collins and former UK agronomy professor Robert Shepherd, contains 20 articles on a wide range of plant genetic engineering technology.

A nearly concurrent event, Collins says, was the hiring in February 1996 of Davies, who came to UK from industry with a solid background in the genetic engineering of plants. Davies, originally from Wales, had worked at the Calgene company in California since 1981, where he focused on genetically engineering canola, or rapeseed, which has traditionally been used to make margarine. (Acres of rapeseed, also known as mustard, make an indelible visual impression—a field of flowing, brilliant gold.) The purpose of Calgene's work with this crop was to alter the composition of the oil for new applications, for making detergent products, soaps and shampoos, for example.

"This work at Calgene was very much a collaborative effort," Davies explains. "I managed the project with one other scientist, and we were supported by several technical staff." The goal of the research was to cause the rapeseed plant to manufacture lauric acid, an important ingredient in detergent products and soaps. This acid is currently obtained from palm kernel and coconut oil.

"A million tons of lauric acid are imported by the U.S. every year, and as the demand for various soap products was rising worldwide, U.S. companies were inter-

ested in finding a domestic source for lauric acid," Davies says. Huge new markets for personal care products were then opening, he explains, in developing countries like China, where more and more people could suddenly afford to buy products like laundry detergent.

In their work, the Calgene team used a local wild plant — the California bay — which also produces lauric acid. The researchers put a gene from the bay plant into the rapeseed plant to see what changes would occur in oil composition. Once they had a base measurement of the changes that resulted, the group, by increasing the number of bay genes inserted, "tuned the process up" to get higher lauric yields. The result, after eight years of work with the rapeseed plant, was a commercially viable product that is now in successful production.

"Maelor was hired here primarily on the basis of his very successful work at Calgene," Collins says. "There's a commonality of course in using the techniques of biotechnology with various plants, and Maelor was eager to take up the challenges here of bioengineering the tobacco plant for commercial potential."

New Faces at THRI

"When I saw the ad for this job, it just spoke to me," says Assistant Professor Deane Falcone, who joined the plant biotechnology group at THRI in January of last year. Falcone, who has a Ph.D. in microbiology from Ohio State University, came from the Carnegie Institution of Washington at Stanford University, where he worked as a postdoctoral fellow for four years.

"At Stanford I worked with Chris Somerville, one of the top plant biologists in the country," Falcone says. "This was a tremendous experience for me, since Chris is one of the pioneers in using mutagenesis to solve problems in plants." Mutagenesis is a process of generating stable, genetic changes in plants.

Falcone's research plan is focused on a new way of genetically engineering tobacco to make various compounds, some of which may have commercial uses. Falcone explains that plants already make a diverse

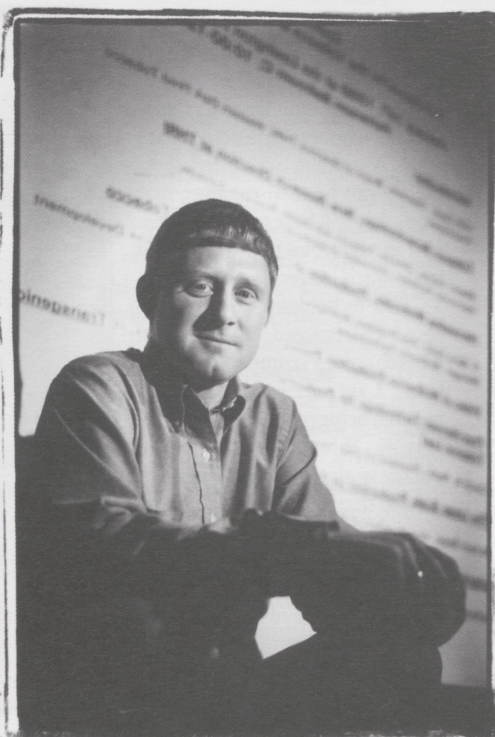


photo by Lee Thomas

ORLANDO CHAMBERS IS INVOLVED IN IDENTIFYING COMPANIES THAT MIGHT BE INTERESTED IN USING THRI'S EXPERTISE IN PLANT BIOTECHNOLOGY IN ORDER TO "GROW" SPECIFIC PRODUCTS IN TOBACCO.

array of compounds, that 25 percent of all medicines, in fact, are made by plants. Falcone characterizes the tobacco plant as a "willing factory"; his work specifically involves tinkering with tobacco's genetic structure in order for the plant to make its less abundant compounds in much greater amounts.

"Although tobacco makes hundreds of compounds naturally, in order for them to be useful commercially we have to cause the plant to over-accumulate these substances," says Falcone. By "useful," Falcone specifically means useful to firms in the business world that might be interested in striking up a partnership with UK, companies which would use THRI's technology in order to "grow" their products in tobacco.

Falcone describes the work he does in the lab as "complicated science but simple procedure," admitting that what he does isn't exactly a spectator sport.

His genetic tinkering takes place in a

petri dish, in which a cut tobacco leaf is exposed to a culture of bacterium commonly used as a transport system for any genetic material Falcone wants to put into tobacco to cause it to over-accumulate already-present substances. The gene is introduced into the bacteria which, in turn, invade and infect the exposed cells of the plant, inserting the introduced genes into the plant's cells. "We can then grow an entire tobacco plant from just one of these cells," Falcone says. "We call the process 'regeneration'; the payoff is that every cell of the new plant will contain the new gene.

"But don't the bacteria kill the plant cells?" Falcone asks rhetorically, in anticipation of that question. "No — because any 'bad genes' have been taken out of this particular bacterium."

He explains that plant geneticists commonly use a species of bacteria called *Agrobacterium*, which causes galls — large tumor-like protuberances — in plants. This bacterium introduces part of its own DNA into a plant cell's DNA and overwhelms the infected cells; the galls are the dramatic evidence of the bacteria's success.

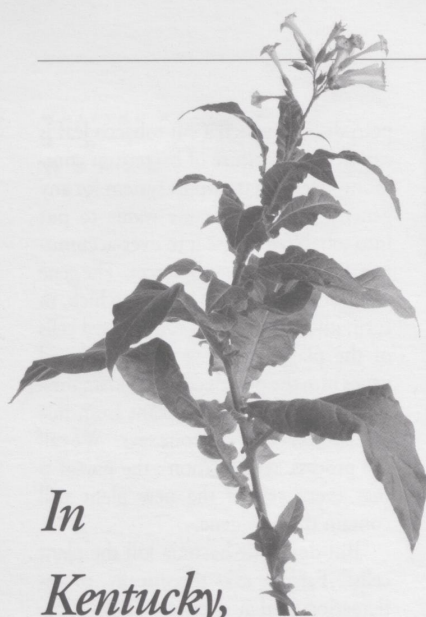
"The tumor-causing genes have been removed, though, from the bacterium we use; it is disarmed. What's left is the DNA necessary to do the transformation," Falcone says.

In this process, Falcone doesn't know exactly which substances will over-accumulate in the altered plant. The important thing, he says, is that the over-produced compounds can now be identified (by biochemical assays or analytical methods) and then isolated.

This basic science is not only important in furthering knowledge of plant genetics, Falcone says, but is also a starting point to interest business and industry in the possibility of using UK-developed technology to make naturally derived materials ranging from insecticides to pharmaceuticals.

As a result of work on the basic science of plant bioengineering, another aspect of the process will be better understood — the development of "promoters." Promoters are sections of DNA which must be coupled with a gene in order for the gene to "ex-

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*In
Kentucky,
tobacco
accounts for
25 percent
of total farm sales.*

press," or function, in plant tissue.

"If we want to put a plant or animal gene into tobacco, we have to attach it to a promoter for the gene to work," says Davies. "It kick-starts the gene into action, you might say." The gene itself, Davies explains, is like the software on a computer: it can't be activated without an operating system. What's important about a promoter is that it activates the gene and also tells it when to turn off.

Part of the swirl of activity at THRI now involves the development and, hopefully, patenting of new genetic promoters and "switches" which will serve as the starting motors in the process of turning tobacco plants into gene-making sources of new products. This research focus is what led another new hire — Susheng Gan — to THRI.

"I came to UK from the University of Wisconsin because of the unique, new program here in biotechnology," says Gan. "I

like to do both basic and applied research, so this is a perfect setting for me." While at the University of Wisconsin, Gan invented a molecular technique that delays plant aging. According to Gan, this technology can be used to create new crops that will have higher yields as well as vegetables that will remain fresh much longer.

"This technology has been patented and licensed out to several biotechnology companies," says Gan. "I am very happy to see my research being put to practical use."

It was through several years of intense work on plant aging at Wisconsin that Gan discovered and identified six "aging genes" from a weed called *Arabidopsis*. He isolated the promoters of these genes and coupled one of the promoters to a well-established anti-aging gene and, in a sense, turned the aging process against itself.

"When we put the new hybrid gene into a plant at the onset of aging, the aging promoter is activated to direct the anti-aging gene to manufacture cytokinins (a type of plant hormone that inhibits aging). In doing this we, in a sense, re-program the plant's aging process," Gan says.

The results of the genetic inducement are dramatic. A non-engineered control tobacco plant begins to show some yellowing leaves after six weeks; at 20 weeks, the plants leaves have nearly all turned brown and have wilted. The 20-week-old transgenic plant is vibrant and green, its leaves still sturdy.

Gan is continuing his research on what he calls "leaf senescence" at THRI, work which will not only contribute to basic knowledge regarding how and why plants age, but will also allow plant geneticists to devise more sophisticated ways to genetically manipulate senescence for agricultural improvement.

"Senescence research will lead to the development of new tools for tobacco biotechnology," Gan says.

"Susheng and Deane were hired for their expertise in specific areas of plant bioengineering research," Davies says. "And Orlando Chambers was an important new addition, since he has a very relevant back-



photo by Lee Thomas

DEANE FALCONE CHARACTERIZES THE TOBACCO PLANT AS A "WILLING FACTORY." HIS WORK INVOLVES TINKERING WITH TOBACCO'S GENETIC STRUCTURE IN ORDER FOR THE PLANT TO MAKE ITS LESS ABUNDANT COMPOUNDS IN MUCH GREATER AMOUNTS.

ground as an ag economist." Indu Maiti, who has a solid background in developing promoters, and Quinn Li, who has considerable experience developing transgenic tobacco plants, complete the program team. "These are the most ideally suited individuals you could imagine to move our work to the next level," says Davies. An additional scientist with expertise in disease resistance will join the group in the near future.

The Commercial Payoff

Even though the THRI program is in its early stages, the business community has already shown an interest in the growing UK expertise in genetic manipulation of plants. One company that is collaborating with THRI is Biosource Technologies Inc. of Vacaville, California. Biosource has been operating a 22-acre tobacco field in Owensboro, Kentucky, for two years, producing genetically engineered proteins for use as infection-fighting drugs.

"We ground up 165 tons of tobacco leaves last summer," says Barry Holtz, vice president of process development for the company, who adds, "This isn't a drill — this is the real thing." The real thing in this case, the end product, is an antibiotic that kills bacteria in a new way — by creating a hole in the cell membrane of bacteria.

The tobacco institute can not only offer such companies the facilities to carry out this kind of high-tech agriculture, but can also provide the technical and academic expertise to support it, Davies says.

"One reason BioSource decided to establish its field operation in Owensboro was the expertise at the University of Kentucky in plant biotechnology," Holtz says. "The fact that Maelor was brought in (he used to work just down the road from us in Vacaville) and the work we've done with Scott Smith in agronomy and with others at UK added up to a nice confluence of factors that helped us make up our minds."

Another THRI research collaboration is with InterLink Associates Inc. of Princeton, New Jersey. This relationship, which began last July, combines InterLink's developments of novel, bioactive peptides with THRI's expertise in plant transformation and the development of genetic promoters. "This is an ideal relationship," says Davies. "We have the technology and knowhow; they have the marketing ideas. They can develop commercial possibilities, which is difficult for universities to do, and which would be outside THRI's mandate."

The objective of this work will be to see if the InterLink peptides introduced into tobacco by THRI scientists will raise resistance to plant diseases such as tobacco blue mold, and to assess the potential for large-scale production of such peptides using the tobacco plant.

Blue mold is a major nemesis of tobacco, and currently all breeders can do to fight it is use the natural defenses of the tobacco plant and try to breed in characteristics from other tobacco varieties to strengthen this resistance. "If we had some agent that could kill blue mold, we could introduce that into the plant, even if it's an antifungal agent made by spiders — or giraffes," says Davies. Last year in Kentucky, blue mold caused an estimated loss to farmers of \$165 million.

A third THRI industry relationship was

established last November. This agreement between THRI and United Agri Products (UAP) of Lubbock, Texas, is enabling the company to develop new crop varieties containing a genetic promoter which was developed at THRI by Robert Shepherd and Indu Maiti of UK's agronomy department. UAP is interested in developing a series of major agricultural crops with improved farming practices. The soybean will be the initial crop of interest.

While THRI's focus remains firmly on tobacco, Davies is pleased to see THRI-developed technology used by others to improve other crops farmed in Kentucky. "And by establishing these relationships with companies, we have their attention when we make newsworthy developments with tobacco," he says.

The Future of Plant Bioengineering

Many questions remain unanswered concerning this new tobacco production. Intellectual property rights, the cost of crop development, and how this new tobacco production will coexist with the production of traditional tobacco must be considered.

"For commercialization to be feasible, it will be necessary for the production to be

profitable for the farmer *and* for the processor," says Chambers. "Markets for the products will need to be available and long term to ensure an adequate return on the cost of R&D."

And if this is to be the growing area of research and development that it appears to be, the question could be asked where the plant biotechnicians of the future will come from.

"We'll be supplying our fair share from right here at UK," is Collins' answer. "We started a new undergraduate degree program in 1988 in agricultural biotechnology," he says, "and this program has taken off tremendously." The program currently has about 110 students enrolled, and it graduates from 16 to 20 a year, Collins says.

In looking back at his year and a half of working to get the THRI plant biotechnology program off and running, Davies says he is pleased that UK has built several new relationships with companies and has revitalized others.

"Things have moved along faster than I would have thought," he says. "I believe this will be a snowballing kind of thing: the more companies that we can form partnerships with — and who realize the benefits of such a partnership — the more will jump on the bandwagon. These next few years are going to be very exciting." ■



photo by Lee Thomas

SUSHENG GAN HAS INVENTED A MOLECULAR TECHNIQUE THAT DELAYS PLANT AGING. THIS TECHNOLOGY CAN BE USED TO CREATE NEW CROPS THAT WILL HAVE HIGHER YIELDS AS WELL AS VEGETABLES THAT WILL REMAIN FRESH MUCH LONGER.

Only 12 percent of the 2,000 adults surveyed said it was common for children to treat people with respect.

WHY DO ADULTS HOLD TEENAGERS AND CHILDREN IN SUCH LOW ESTEEM?

BY
HEIDI BRIGHT
PARALES

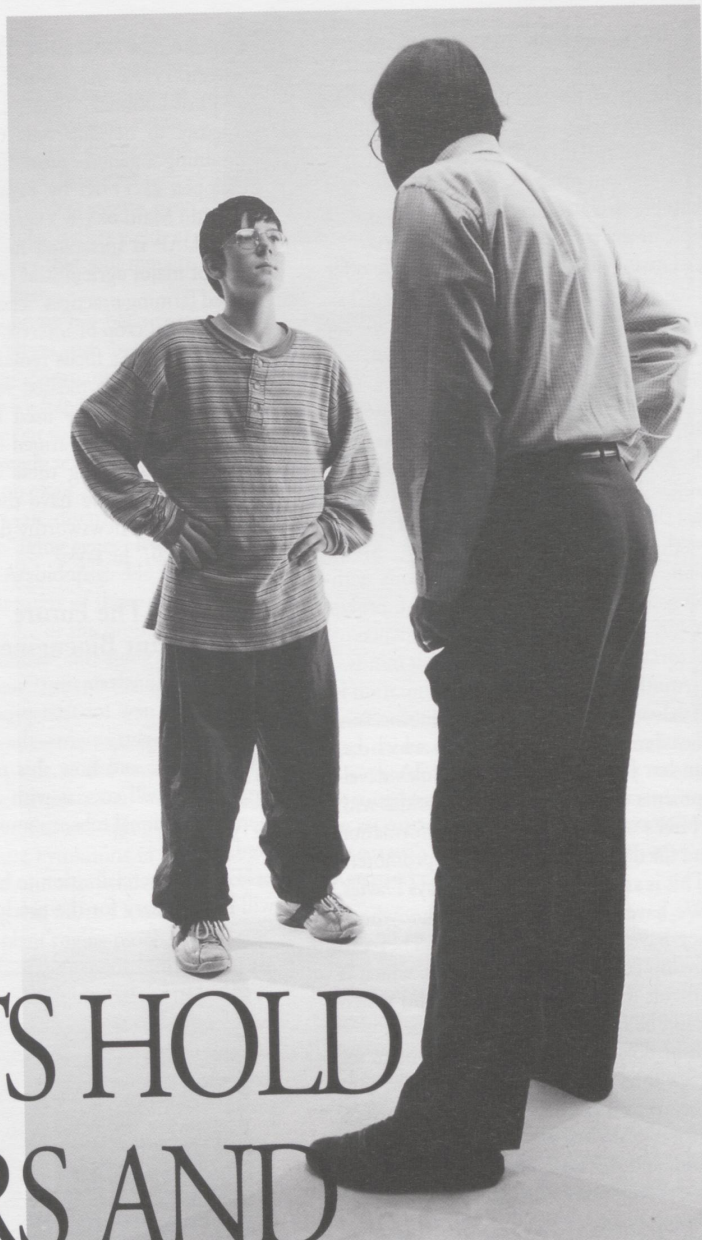


photo by Lee Thomas

UK Researchers Respond to Public Agenda Study

Kids and teenagers are ruder and wilder and more irresponsible than ever before. This is the conclusion that could be drawn from a recent national study by a public policy research organization based in New York. The study, titled "Kids These Days: What Americans Really Think about the Next Generation," found a stunning level of antagonism not just toward teenagers but toward young children as well. Ninety percent of the respondents said youngsters have failed to learn values.

"Adults are not confused and they're not ambivalent," says Deborah Wadsworth, executive director of Public Agenda, which conducted the study. "Instead, they're virtually riveted by the need to teach kids integrity, ethical behavior, respect and civility." Only 12 percent of the 2,000 adults surveyed said it was common for children to treat people with respect.

Are kids and teenagers really so bad these days?

Several researchers at the University of Kentucky certainly believe these negative perceptions are understandable. One reason is that the role of children in society has changed significantly from previous generations, according to William Turner, associate professor of family studies. "Children are far more visible today," he says. "Children are assuming adult roles earlier than they used to."

In previous generations, children remained close to their families longer — they worked on the farm, in their family business or in their neighborhoods. "There was far less contact between adults and children who were not their own," Turner says. "Today, however, more children are working and interacting with others away from their families or familiar environs. Adults encounter more children they don't know than in previous generations."

Because they interact with children and adolescents more, adults tend to see more aberrant behavior than they might have in earlier times,

when adult-child interactions occurred less regularly, he explains.

At the same time, other social norms are in flux, Turner adds. "Whereas a generation ago children were likely to be encouraged to be polite, courteous, and respectful, especially toward adults, today messages from the significant adults in their lives are likely to emphasize self-respect, self-assertiveness and self-esteem. Children are constantly being reminded of the virtues of standing up for their rights and having positive self-esteem."

These messages often pose a conflict for young people who may not know where to draw the line between asserting themselves and respecting others, he says. "Whereas there is virtue in these self-respect messages, unfortunately, the messages extolling the importance of respecting others, especially those who are older, are often lost."

As general exposure between adults and

children has increased, adults also receive more exposure to the aberrant behavior of some kids through the media, according to Turner. "Children are often presented as violent, dangerous and disrespectful toward adults."

In contrast, he says, TV shows in the '50s to the '80s tended to present kids in a more favorable light, and conflicts could be resolved in half an hour by all-wise parents and a little ingenuity. Consequently, adults often expect children to be like the Brady Bunch or the Huxtable Kids, and instead are confronted with latch-key youngsters having to raise themselves, or street gangs, teenage parents and drop-outs.

The news media also tend to report violent behavior more than in the past, Turner says. Landmark events such as children murdering their parents occurred in previous decades, but those events were far less likely to receive the barrage of media coverage they get today, he says. "Many of those events were kept quiet because those crimes were committed by juveniles. Today, these events are widely reported in the media, with one consequence being that adults characterize the whole generation of adolescents by the actions of a few," he says.

Professor of psychiatry Otto Kaak (pronounced "cake") agrees. "Adolescents who go on killing sprees — that gets widely covered," he says. "The media don't talk too much about the kid who got the scholarship; that doesn't seem to get much play."

Movies also affect cultural attitudes toward children. For example, "The Bad Seed" and other films where children embody evil can cause a negative attitude to become ingrained, says Kaak. "There seems to be some fascination with kids embodying evil. As popular as some of these films are, you have to think they have an impact on adult perceptions."

Overall, Kaak says, adults' negative perceptions may have to do with how they were brought up, and using that experience as a standard. "There have always been a few kids who don't do

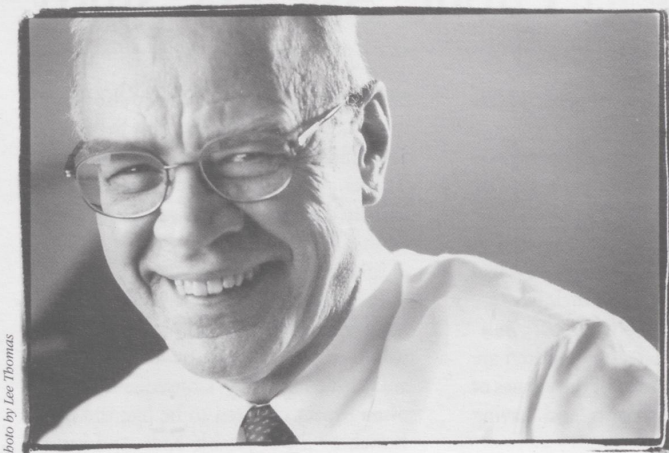
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"For adolescents to be in school — in class — at 7:30 in the morning runs squarely against their biological clocks. Teens are the most sleep-deprived group in our society."

— Catherine Martin



WILLIAM TURNER SAYS THAT ONE REASON FOR ADULTS' NEGATIVE PERCEPTIONS ABOUT ADOLESCENTS THESE DAYS IS THAT IN PREVIOUS TIMES CRIMES COMMITTED BY JUVENILES WERE GENERALLY KEPT QUIET.



“Adults thinking about children like this is really nothing new. Since Plato’s time — or maybe before — adults have generally thought the next generation is terrible, that they have no respect for their elders, that they’re going to pull us down.” — *Otto Kaak*

well. The problem comes when we overgeneralize that fact to the entire group.”

Are these negative perceptions based on reality? Perhaps, though several of the researchers responding to this study hold some reservations.

One such reality is purely biological. Catherine Martin, an associate professor of psychiatry at UK does research on the risky behavior of teens. She says she believes if adolescents are irritable, they have plenty of reason to be.

“The biological changes an adolescent goes through aren’t really appreciated or accommodated by adults,” she says. A teenager’s hormone secretion cycle, for example, is extremely active during the night, she explains, which causes teens to need more sleep, generally, than they get.

“Students at this age are undergoing very rapid changes in hormonal rhythms,” Martin says. “For adolescents to be in school — in class — at 7:30 in the morning runs squarely against their biological clocks. Teens are the most sleep-deprived group in our society.”

Apart from the physical changes of adolescence are the changes in the structure of our society in recent years, says Joanna Badagliacco, assistant professor of sociology. “I think children are facing different things than we have faced,” she says.

One difference is access to more media. “This generation is far more influenced by change and what’s available to them,” she

says. “We use the TV, videos and the Internet to baby-sit kids, and they see a lot of different things there that influence how they think they ought to behave, or what is ‘cool.’”

Another new reality is that gangs, formerly thought to roam only in poor inner-cities, have become more visible now even in upper-income communities, says Turner. Along with the growing gang problem is the greater acceptability of drug use among kids, he adds. “In many instances now, the cool kids are the ones on drugs. There has been a change in the culture in general about this,” he says.

Part of this might be due to the fact that many of the parents of these kids smoked pot themselves when they were adolescents in the ’60s and ’70s, he says. Some parents now have a conflict about what message to give their kids about drugs, especially if they have continued to use drugs on a “recreational” basis. The children say to them, “You did it then, and you’re still doing it. So, why can’t I?”

Even if the parents don’t use drugs now, the messages might be the same. Parents who bought into the hippie philosophy may have experimented with free love and free thinking, and many of them passed along these values to their children — that they should express themselves, not be conventional, look for new and different experiences. “I especially see this in highly educated people who value independence

and free thinking,” Turner says. “Some of their choices in raising their children had consequences unforeseen by the parents.”

Another consequence of teaching children to stand up for themselves is their greater aggressiveness, says Turner. Along with this is a growing reluctance among adults to attempt to correct negative behavior in others’ children. “Before, adults would correct others’ children, and the children’s parents would thank them for doing it,” Turner says. “Now, children are more savvy — they know the other adult can be accused of child abuse.”

According to the Public Agenda report, only 33 percent of Americans feel very comfortable telling a neighbor her child had gotten into mischief. One California respondent said, “Now if I go out there to say something to somebody else’s kid, I may get cursed.”

One of the biggest structural changes in this generation is the growth in single-parent households and families in which both parents work outside the home. Children are more often left to navigate much of life on their own, says Badagliacco. Turner agrees. “Parents are very busy with their jobs and often work on weekends,” he says. “Many families rush through homework and dinner, and then it’s time for bed.” This lack of parental time has contributed to a reduction in children’s participation in activities that teach values, such as scouts and the “Y.”

ODYSSEY

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Badagliacco addressed other current economic realities of life by adding that the United States is the only first-world country that doesn't put sufficient money into taking care of young children, making life a greater hardship for many families than it could be.

Another economic reality is the hopelessness faced by children in the inner cities, she says. "Finish high school to work for minimum wage?" she asks rhetorically. "They don't have any hope for surviving well, and we don't give them the opportunities."

Turner sums up the reality behind the negative perceptions: "Our culture is much more violent and there are much greater consequences than in the past," he says.

But perhaps the old cliché rings true: The more things change, the more they remain the same. According to Kaak, "Adults thinking about children like this is really nothing new. Since Plato's time — or maybe before — adults have generally thought the next generation is terrible, that they have no respect for their elders, that they're going to pull us down."

Badagliacco adds, "It is a major myth that there was a time in the past when the family unit was just fine, and now the next generation is causing the break-up of society. Every generation has thought the next generation had problems, and today the adults see the children as disrespectful, lazy and living by different values."

Turner agrees. "I'm not so sure it's tremendously different from times in the past," he says. "Generation X is portrayed as having no real values, causes or beliefs. It's called the Me Generation because they are considered selfish, without a social consciousness."

"But when I talk to them, I find diversity, and I find many are passionate about many things. We're living in a time when there is no great cause to rally around, like the Civil Rights Movement or Vietnam. There is nothing so unifying or dramatic. We don't know how

to label them, and this leads to some of the negative perceptions about them.

"Every generation has some negative thinking toward its adolescents," he continues. "Parents have always been concerned about the next generation, though perhaps not to the same extent as now. Adolescents are trying to find themselves, establish their own identity. In the process, they often reject the values taught to them. But there is evidence that most come back to their parents' values as they mature."

Kaak supports this claim, citing a study on the younger generation's values conducted by Daniel Offer at Northwestern University. This study found that adults' perceptions that children and adolescents have a very different "code of value" are incorrect. In this Chicago-based study, Offer found that about 80 percent of the group they surveyed has pretty much the

same values as their parents. "This work has been replicated by others," Kaak says.

Perhaps the negative perceptions of adults are based more on fear than reality, suggests Badagliacco. "As baby boomers are getting older, they are becoming more fearful about who will take care of them when they no longer can take care of themselves," she says. "Many adults now find themselves a sandwich generation, taking care of both their parents and their own children. If teenagers are rejecting our values, and not acting the way we expect them to, will they help their parents when they need them to? Those are serious fears for aging Americans because we don't have societal custodial care."

The issue of socialization also comes into play, Badagliacco says. Children are not isolated — once they start to watch TV and go to preschool, they are socialized by other influences. This continues as they enter churches, schools and are more exposed to the media.

According to the study, there also is a tendency for adults to blame schools for the moral problems of children. The public wants the schools to supplement and reinforce values that parents should supply. However, many adults in the study pointed out that the social environment tolerated at school undermines what parents are trying to teach their children at home.

Badagliacco points out the problem here is that parents are willing to blame the schools but don't go in to assist the teachers or support tax increases for schools. In addition, she asks, "Why don't we pay teachers well?"

Overall, says Badagliacco, "This country really needs to see children as a public asset, a group we should nurture and assist. Not everyone is willing to do this."

Turner adds, "I think families and schools have to work much better together if we're going to see changes. I think as a society we have to reassess our values and decide what's important to us." ■

TV shows in the '50s to the '80s tended to present kids in a more favorable light, and conflicts could be resolved in half an hour by all-wise parents and a little ingenuity. —William Turner



photo by Lee Thomas

"IT IS A MAJOR MYTH THAT THERE WAS A TIME IN THE PAST WHEN THE FAMILY UNIT WAS JUST FINE, AND NOW THE NEXT GENERATION IS CAUSING THE BREAK-UP OF SOCIETY," SAYS JOANNA BADAGLIACCO.

UK RESEARCHERS SURGING AHEAD WITH HIGH-SPEED COMPUTER NETWORKS

“We are made of star stuff,” says Gary Ferland, a University of Kentucky professor of physics and astronomy, as he reaches across his desk for a nearby book. He opens it to a stunning photograph. A star, millions of light years away, is pushing gases into space, the result of a nuclear reaction taking place inside the star. The reaction creates a billowing cloud of yellow-gold blossoming against the black backdrop of space.

While most of us merely marvel at the beauty of such an image or the ability of science to photograph it, astronomers such as Ferland use these images to understand complex processes taking place in the galaxy. By studying the light, scientists can determine the age of stars. They can even tell us that our skin contains some of the very atoms found in such stars. Ultimately, they hope to answer questions that have forever intrigued mankind — questions no less weighty than where we came from and how the universe was created.

Unlike other scientists, however, astronomers cannot conduct hands-on experiments to further their research — nobody can do an experiment with a star billions of light years away. Astronomy is an observational science. And now, in addition to instruments like the Hubble Space Telescope, Ferland and his fellow stargazers can simulate conditions in the galaxies with computers and then compare those simulations with other data from the heavens.

These simulations require massive computing power and an ability to communicate via computer with other researchers around the world. It is precisely the sort of computing challenge that excites John Connolly, director of UK’s Center for Computational Sciences.

Connolly came to UK when the center was founded in 1987. Governor Martha Layne Collins established computational sciences as one of only five Centers of Excellence in the state, and a special \$5 million appropriation from the Kentucky legislature that same year provided funds for the university’s first supercomputer.

In the 10 years since that time, the center’s mission has been to support researchers in multiple disciplines across campus by meeting their needs for a computer network able to process computations several hundred times too complicated for even the most high-powered personal computer. The center also funds fellowships for professors and graduate students doing research that requires cutting-edge computing.

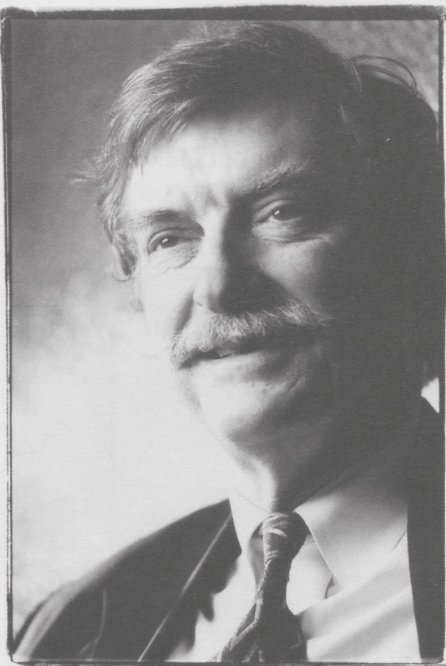
Expanding the Horizons of Knowledge

According to Connolly, the biggest demand for the center’s computational services typically comes from Ferland’s counterparts in hard sciences such as physics or engineering.

“This is the kind of thing a university should be doing, expanding the horizons of knowledge,” Connolly says of Ferland’s work. “It is a good example of pure science, interesting in and of itself. It extends our knowledge and keeps us in close contact with what others in the field are doing. It keeps us up to date.”

Still, these scientists are far from the only beneficiaries.

In a corner office on the 13th floor of Patterson Office Tower, two computers hum on the desk of another scholar, Kevin Kiernan, a professor in the Department of English. Since 1993, Kiernan has



JOHN CONNOLLY, DIRECTOR OF THE COMPUTATIONAL SCIENCES CENTER, SAYS THAT WITH THE NEW UK LIBRARY, THE LARGE COMPUTERS IN THE CENTER AND THE EXPANDED NETWORKS, "IT'S ALL COMING TOGETHER."

been immersed in a project that will soon result in a two-volume compact disk called *The Electronic Beowulf*.

As he opens a test version of the disk, a page of the ancient poem soon appears on the computer screen. The page is a digitized copy from the only original manuscript of *Beowulf*. The Old English letters are there to examine. The color and texture of the manuscript's vellum leaf is visible. Even the tape used to attach the pages to a paper frame can be seen.

Perhaps most significant, the edges of the manuscript are visible, revealing hundreds of letters or parts of letters covered by frames which were designed to preserve the fragile text after the edges were seared in a 1731 fire. Even the few researchers previously allowed access to the manuscript could view the hidden letters only if they held the page up to bright light.

Kiernan's work — made possible by the center's computational support — will change virtually everything about the way scholars study what is considered the most important work of Old English literature. Not only will they be able to read the original 11th-century manuscript electronically, they will be able to examine copies made by two scribes in the 18th century, as well as 19th-century collations and editions.

"Now, for example, scholars interested in the construction of the original gatherings of the manuscript will be able to place once conjugate leaves side by side again, or examine in great detail the color and texture of the vellum leaves by magnifying the images," Kiernan writes in an article on a Web site about the project. "Anyone interested in the accuracy and diligence of the scribes, moreover, can investigate all of their erasures, which have been scanned both in bright daylight and with the sometimes more penetrating aid of an ultraviolet lamp. And, with the help of image processing programs, students will even be able to restore or at least improve the

legibility of faded passages. Readers of the electronic facsimile will thus acquire a reproduction of the manuscript that reveals more than the manuscript itself does under ordinary circumstances."

A Marriage of Scholarship and Technology

Neither scholarship nor technology alone could have achieved these results, a fact not lost on Kiernan or Connolly.

"The Center for Computational Sciences helped us with research support," Kiernan says. "They also showed us ways to deliver all these images. Their role was crucial. Without their help, none of this could have happened."

The project is a good example of the difference between computational science and computer science, a distinction which eludes many and is a perennial question for

Connolly and his team.

"Computational science is any kind of science that uses a computer," Connolly says. "Computational science uses the computer as a tool. The computer is just a device for getting your work done, doing your calculations. Computer scientists are actually interested in the machine itself, in designing new machines and making them work more efficiently through better software, for example. They are designing the next generation of machines that computational sciences will be using five years from now."

The *Beowulf* project is also an excellent example of the interdisciplinary nature of the center. In fact, Connolly delights in bringing together experts from different disciplines.

Kiernan, for example, struggled with assembling the computer codes that would make it easy for people to look at different pages

of the manuscript using the various tools. The center provided money for a computer science graduate student who worked with him to develop the tools for

**"WHAT WE TRY TO DO IS GET DIFFERENT
LEVELS OF EXPERTISE TOGETHER,
KIND OF SERVE AS A BROKER."**

— John Connolly

*continued
on page 14*

KEVIN KIERNAN, A PROFESSOR IN THE DEPARTMENT OF ENGLISH, HAS BEEN IMMERSED IN A PROJECT MADE POSSIBLE BY CENTER OF COMPUTATIONAL SCIENCES SUPPORT THAT HAS RESULTED IN A TWO-VOLUME COMPACT DISC CALLED THE ELECTRONIC BEOWULF, A DIGITIZED COPY FROM THE ONLY ORIGINAL MANUSCRIPT OF THE ANCIENT POEM.

looking at manuscripts.

"The graduate student will get a dissertation out of it," Connolly notes. "What he is doing is developing the kind of tools that future libraries are going to use."

This multi-disciplinary, interdepartmental approach helps the center vault typical administrative barriers.

"What we try to do is get different levels of expertise together, kind of serve as a broker," Connolly says. Somebody from one department may have skills that someone from another department needs. In the ordinary structure of a university, you can't support that. The English department can't pay the computer science department or vice versa, but I can do that. I can pay the salary of a computer science student to work on a project in the English department. You have to have an interdisciplinary center to do that."

Multiple Disciplines, Common Computing Needs

The need for serious computing power crosses all disciplines. The huge size and complexity of computer files is a common denominator in all the research projects, whether the scholars are studying galaxies or literature. For example, Kiernan used a Roche/Kontron ProgRes 3012 digital camera to scan text at 2,000 x 3,000 pixels in 24-bit color. The resulting images are enormous, nearly 22 megabytes apiece. They require at least 64 megabytes of RAM to process in real time.

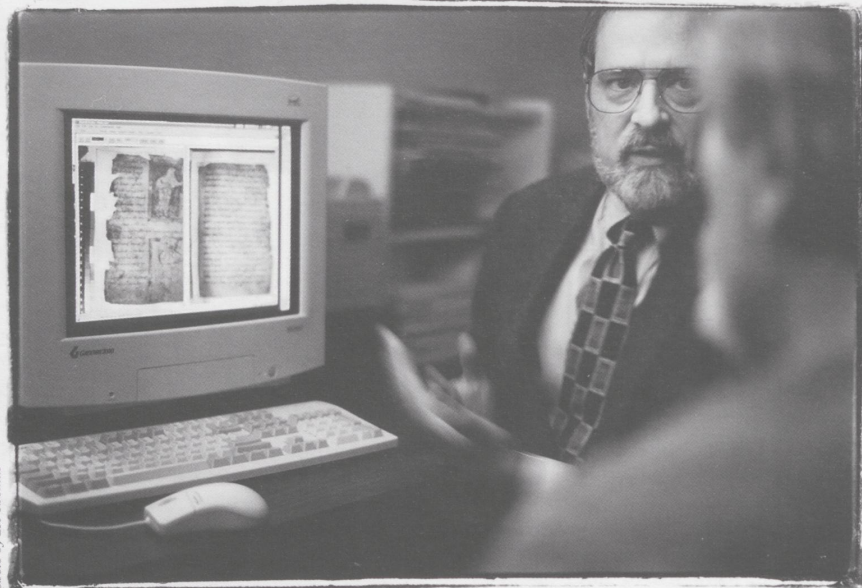


photo by Lee Thomas

Across campus, James McDonough, an associate professor of mechanical engineering and mathematics, is doing research that is literally worlds apart from that of Kiernan's in every regard but one: McDonough's research requires comparable computing power. Applying the principles of computational fluid dynamics, McDonough and Kozo Saito, a UK professor of mechanical engineer-

ing, are seeking to improve the current method for painting cars.

By way of background, McDonough explains that all auto manufacturers lose around 50 percent of the paint they try to apply to the car shells. The cars are painted in a painting booth by robots which direct spray guns filled with paint at the shells. The paint particles which do not attach to the car are blown into a trap beneath a grated floor and then further trapped by filters so they do not escape into the atmosphere. It is an expensive process. Not only do they lose the cost of the paint, the manufacturers also have to continually replace the expensive filters.

Toyota Motor Manufacturing North America turned to the UK researchers to develop a better system. Now three years into the long-term project funded by Toyota, McDonough and Saito are doing computer simulations, mathematical calculations and laboratory

experiments that will ultimately result in a more cost-efficient painting system. It is not unlike the research McDonough has done for General

NSF HAS RECENTLY AWARDED \$830,000 TO THE SOUTH EAST PARTNERSHIP TO SHARE COMPUTATIONAL RESOURCES (SEPSCoR), A PROGRAM RUN BY THE COMPUTATIONAL SCIENCES CENTER. THE GRANT WILL CONNECT SIX CAMPUSES — ALABAMA, KENTUCKY, LOUISIANA, MISSISSIPPI, SOUTH CAROLINA AND WEST VIRGINIA — WITH A 45 MEGABIT/SECOND ATM NETWORK. ATMS PROVIDE TRANSMISSION SPEEDS 10 OR MORE TIMES FASTER THAN EARLIER NETWORKS.

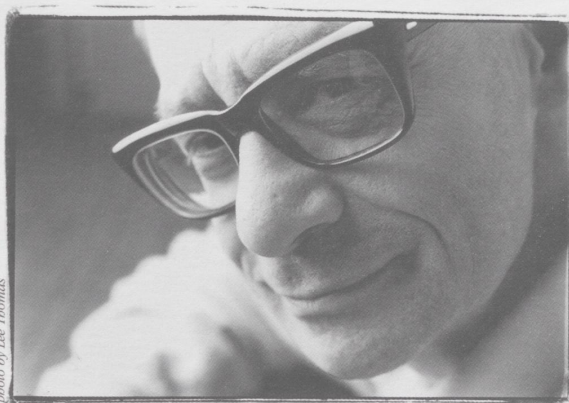
Electric Aircraft Engines in which he used computational fluid dynamics to analyze the air flow inside jet engine turbine blades, to ultimately increase the fuel efficiency of the jet.

Continually Upping the Ante

Computing power is clearly the name of the game when it comes to research dependent on large computations, and the center has been quite successful at attracting the kind of grants that allow it to continually enhance the computing power available to UK researchers.

In May of 1997, the National Science Foundation (NSF) announced that UK was one of 35 institutions allowed to connect with NSF's very high-speed Backbone Network Service (vBNS). In addition to providing connections 1,000 times faster than a personal computer, the network is dedicated to the researchers. The center supported that effort.

In September of 1997, NSF awarded \$830,000 to the South East Partnership to Share Computational Resources (SEPSCoR), a program run by the center. The grant will connect six campuses — Alabama, Kentucky, Louisiana, Mississippi, South Carolina and West Virginia — with a 45 megabit/second ATM (asynchronous transmission mode) network. ATMs provide transmission speeds 10 or more times faster than earlier networks, and this connection will be reserved for use by researchers at campuses in these six states. The Electronic Beowulf will be a primary test vehicle for the



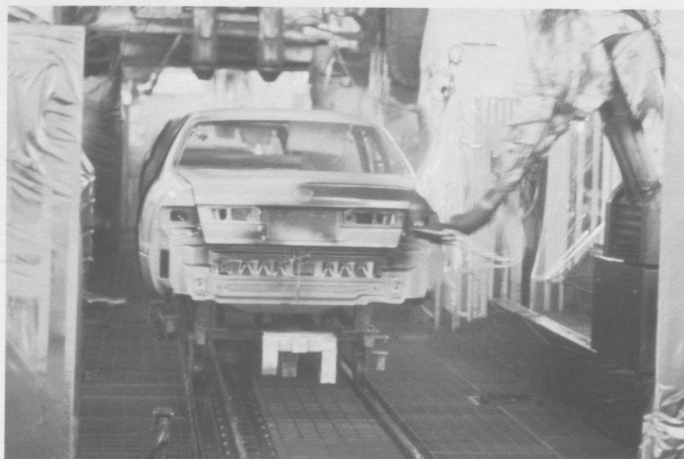
JAMES McDONOUGH, AN ASSOCIATE PROFESSOR OF MECHANICAL ENGINEERING AND MATHEMATICS, IS APPLYING THE PRINCIPLES OF COMPUTATIONAL FLUID DYNAMICS TO IMPROVE THE CURRENT METHOD FOR PAINTING CARS.

SEPSCoR network.

For most of its existence, the center has also received grants to run a program called ESPCoR, a federal/state program designed to help rural states, typically far from major computer nodes, develop top research programs. UK was the only ESPCoR state to receive a recent grant through NSF as one of 10 major partners with the University of Illinois to contribute to a National Technology Grid. The Grid will allow computational science centers all over the country to share resources.

"This is like a huge cooperative," Connolly says. "It is brand new in science. It has never been done before."

"Never been done before" is simply a way of doing business for the center, particularly since the researchers have had access to the center's HP-Exemplar computer, one of the best supercomputers on the market, according to Connolly. The Exemplar is a parallel computer, providing both speed and flexibility.



AUTO MANUFACTURERS LOSE AROUND 50 PERCENT OF THE PAINT THEY TRY TO APPLY TO THE CAR SHELLS. THE CARS ARE PAINTED IN A PAINTING BOOTH BY ROBOTS WHICH DIRECT SPRAY GUNS FILLED WITH PAINT AT THE SHELLS.

Both are often needed. Consider the work of Robert Lodder, an associate professor in the College of Pharmacy. Lodder is studying atherosclerosis (hardening of the arteries), particularly its role as a contributing factor to stroke. His work modeling arterial plaque requires billions of computations and high-speed communications.

Using noninvasive cameras, Lodder obtains transarterial three-dimensional images of the different plaques in arteries and then does chemical composition profiles of arterial lesions at various stages of development. These data are

*continued
on page 16*

then correlated with the patient's results from duplex ultrasound and from lipoprotein extraction and separation of the patient's plaques. It is an innovative approach, studying the lesions found in artery walls rather than the tissue removed from the site.

"Monitoring cholesterol in the blood doesn't tell you much about the progression of disease," he says when explaining why he has taken a different path than other scientists. "The action is in the artery walls, where there is a much higher concentration of cholesterol."

The research is also innovative in terms of its use of technology. Lodder is taking advantage of new imaging algorithms for massively parallel supercomputers as well as new intra-arterial fiber-optic cameras.

Lodder says the chemical analysis of the lesions should help researchers understand lesion formation and growth, ultimately leading to better treatment programs and a reduction in the number of people — now more than 500,000 annually — who are affected by stroke.

In one way or another — whether saving lives, money or rare manuscripts — all the research improves our lives, and that is the point of not just the research but of the center as well, according to Connolly. In 1997, the center observed its 10th anniversary, a cause for celebration, introspection and comments about the future.

"It is all coming together," Connolly says. "We are getting all of the components including the new library. We have the computational science center well established. We have the big computers downstairs. We have the networks. Those are the components of the future university — large computational resources, good networks and good repositories." ■

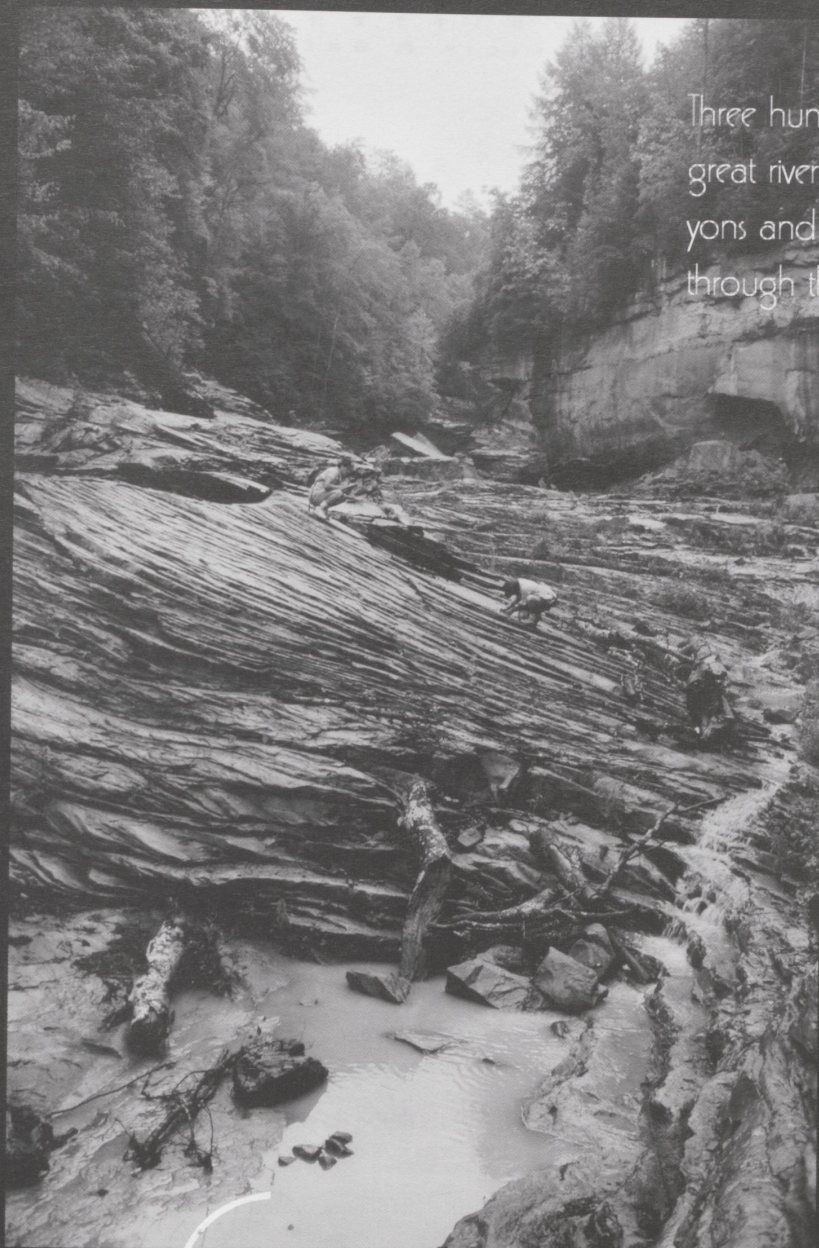
"NOW, SCHOLARS INTERESTED IN THE CONSTRUCTION OF THE ORIGINAL GATHERINGS OF THE *BEOWULF* MANUSCRIPT WILL BE ABLE TO PLACE ONCE CONJUGATE LEAVES SIDE BY SIDE ON THE COMPUTER SCREEN AND EXAMINE IN GREAT DETAIL THE COLOR AND TEXTURE OF THE VELLUM LEAVES BY MAGNIFYING THE IMAGES." — Kevin Kiernan



photo by Lee Thomas

IN HIS STUDY OF HOW ARTERIAL PLAQUE CONTRIBUTES TO ATHEROSCLEROSIS, ROBERT LODDER REQUIRES BILLIONS OF COMPUTATIONS AND HIGH-SPEED COMMUNICATIONS.

Three hundred million years ago, great rivers cut 200-foot-deep canyons and 20-mile-wide valleys through the Appalachian Mountains.



Imagine great rivers flowing along the Appalachian Mountains. Their waters wind through dense forests and murky swamp-lands. Their currents, over many years, have cut 200-foot-deep canyons and 20-mile-wide valleys.

This is the picture geologists Stephen Greb and Allen Archer paint of the Appalachian Mountains 300 million years ago. The two researchers have recently discovered evidence that these long-gone rivers drained much of North America, an area almost the size drained by the mighty South American Amazon, and their findings call into question what scientists believe about the climate in this region 300 million years ago.

"These rivers would have made some great tourist attractions," says Greb, a researcher with the Kentucky Geological Survey at the University of Kentucky. "In Western Kentucky you'd have canyonlands — 200-foot-deep canyons with rivers flowing at the bottom." In what is now Eastern Kentucky broad valleys were filled with sand deposited by rivers over millions of years. These sands became sandstones which are visible in present-day wonders like Natural Bridge, a 78-foot long sandstone arch, and Cumberland Falls, a 68-foot waterfall.

Archer, a geologist at Kansas State University, and Greb map these rivers as two systems. One system likely began in Southeastern Quebec or Nova Scotia, Canada, traveled through the Appalachians in Eastern Kentucky, and emptied 2,300 miles south near the present-day coastal plain of Mississippi and Alabama. The second system began in Southeastern Ontario, Canada, and flowed through Western Kentucky to Arkansas.

CONTINUED ON PAGE 18

SANDSTONE SECRETS:

QUARTZ PEBBLES REVEAL ANCIENT RIVER SYSTEM IN APPALACHIA

In what is now Eastern Kentucky broad valleys were filled with sand deposited by rivers over



millions of years. These sands became sandstones which are visible in present-day wonders like Natural Bridge, a 78-foot long sandstone arch, and Cumberland Falls, a 68-foot waterfall.

W R I T T E N B Y
A L I C I A P. G R E G O R Y

The Quartz Pebble Key

Greb and Archer traced the path of these rivers through two-inch quartz pebbles in sandstone deposits in the eastern United States. Previous research by scientists in Kentucky, Illinois, Indiana, Michigan, Arkansas, Ohio, Pennsylvania and West Virginia revealed rocks of the same age, all containing the same size quartz pebbles. These quartz pebbles were the key to connecting deposits and forming a picture of the ancient rivers.

"Quartz pebbles can't come from any of those states at the time these rivers flowed," Greb says. "Quartz pebbles of this size formed with intense pressure and heat, in areas where mountains are forming or at the ancient cores of the continents." No other natural process could have formed those pebbles, Greb says. The core of North America is exposed in Canada, from the U.S. border to the Hudson Bay area, and he says that is where the quartz originated.

Greb says another clue that these pebbles are far from home is the purity of the sandstones. "These sandstones are 90 to 95 percent quartz grains with very little clay," he says. "The more ocean waters or river currents rework a sand deposit, the more it weathers and erodes, the more dirt you get rid of. These quartz pebbles had to be cleaned many times before they reached this purity."

"We're not the first to connect the similar rocks in each state," Greb says, "but we're the first to quantify the whole drainage area and make comparisons to form what we believe is an accurate picture of what these rivers looked like."

Rivers that Rival the Amazon

The South American Amazon is the largest river in the world in terms of the amount of water it carries. At 3,900 miles long, it's a good modern comparison to these ancient rivers, says Greb. "The ancient rivers rivaled the Amazon in terms of the size of the drainage basin — all of the little rivers flowing in the same direction that fed into the big river," Greb says.

In the United States, the ancient rivers drained an area even larger than the modern Mississippi, which flows from Northern Minnesota to Louisiana. "American geologists tend to view the Mississippi River as big, but it carries only about one-tenth as much water as the Amazon," Archer says.

Greb and Archer say the ancient rivers didn't look like the Mississippi. "The Mississippi, Ohio and Kentucky rivers are snake-like, with little twists and loops," says Greb. The ancient rivers were braided rivers with tear shaped islands where the wide river splits and reconnects. "Some of the individual rivers may have been small, but there were hundreds of them interconnecting and forming a very broad river system," Greb says. Some of the rivers may have been 35 to 40 feet deep and more than a kilometer wide.

But how do they know how the ancient rivers looked? "Modern rivers are our basis for understanding how ancient rivers worked," Greb says. "We study how the sand and mud move in a modern river and apply the layers, grain sizes and textures of those sediments to what we see in the ancient rocks."

Charting the course of an ancient river takes thousands of measurements, says Greb.

"From the layers you see in sandstones, you can determine which way the river was flowing, how fast it was flowing, and how deep the water was." Some of these layers are at an angle. "We measure that angle and it tells us the way the ancient sandbars were moving," Greb says. "The rivers in both systems had sandbars all over the place, with the current changing their shape and depositing the quartz pebbles they contained," Greb says. "We take hundreds of those sandstone measurements to form a picture of how the sandbars were moving."

Greb and Archer used hundreds of measurements taken by other researchers as well, including very detailed research on Kentucky sandstones by Donald Chesnut, Greb's colleague at the Kentucky Geological Survey. "By also combining data from researchers in other states, we can present some interesting interpretations," Archer says.

Greb and Archer's goal was to find the minimum and maximum size of the drainage basin in order to get an accurate picture of the potential size of these river systems. "The first step in finding the minimum is figuring out the closest locations the quartz pebbles could have come from," Greb says. "Then we look at geological structures like mountains, things that would be obvious barriers to the river." To determine the maximum extent of these rivers, Greb and Archer looked at where the sandstone deposits end — where the rivers met the coast mid-way through Alabama. The coast of 300 million years ago was inland from today's coast, says Greb. Ocean covered Louisiana, and parts of Alabama, Georgia, South Carolina, Texas, and Oklahoma.

A Question of Climate

"Kentucky was a tropical paradise 300 million years ago," Greb says. According to widely accepted scientific models, Kentucky was on the equator. "We took the drawing of the equator that other scientists did based on the theory of plate tectonics, commonly called continental drift," says Greb.

"Continental drift is supported by many different types of geological evidence," says Greb. "For instance, you can see something that was deposited in a coral reef in a warm tropical climate is now in Siberia. That tells you the continent has moved."

"When these sandstones were formed in Kentucky, most of the earth's continents were part of a super-continent named Pangea," Archer says.

The fact of Kentucky's tropical past is supported by today's mineable coal resources. "The thick coals we have in Eastern and Western Kentucky needed a tropical climate to form. The best modern comparisons to those coals are in swamps in Indonesia," Greb says.

"We know Kentucky was tropical because these coals formed, but we also found evidence that the climate wasn't continually wet," Greb says. In fact, Greb and Archer's

CONTINUED ON PAGE 20

Greb and Archer traced
the path of these rivers
through two-inch
quartz pebbles in



photo by Lee Thomas

STEPHEN GREB SAYS THAT A SIGNIFICANT APPLICATION TO HIS RIVER SYSTEM RESEARCH, CARRIED OUT WITH ALLEN ARCHER FROM KANSAS STATE UNIVERSITY, IS THE ABILITY TO PREDICT THE LOCATION OF OIL, NATURAL GAS, WATER, AND COAL IN SIMILAR SANDSTONE DEPOSITS.

sandstone deposits in
the eastern United
States. These quartz
pebbles were the key
to connecting deposits
and forming a picture
of the ancient rivers.

findings challenge much of what scientists believe about the climate 300 million years ago. While other scientists hold that the climate was purely tropical, Greb and Archer and a growing group of researchers believe at times the climate may have been temperate or even semi-arid. Greb sums up their theory in one word: oscillation, a cycle of rising and falling oceans.

"When we analyzed these sandstones, and the rocks they cut through, we found sharply sloped valleys," says Greb. "With a very humid, tropical climate we'd expect the valley walls to get rounded with the constant water weathering. To cut a valley 200 feet deep, sea level had to drop 200 feet. To fill the valley sea level had to rise." The valleys themselves support the idea that the ocean was repeatedly rising and falling over time.

Greb and Archer explain that tropical conditions prevailed as sea levels rose, moving the coast more than 200 miles inland until it reached Kentucky. "We found new evidence that tides and waves reworked sandstones near the top of the valleys, so we were much closer to the shore than previously thought," Greb says. As ocean waters washed in, the sand-filled valleys became shallow swamps with frequent rain, humidity, and abundant plant life. These plants decayed, forming peat, the precursor to coal.

"The fact that we can find evidence of many different swamps in this time period tells us that the ocean continued rising and falling, and sometimes Kentucky was covered by shallow seas, sometimes it was a swamp, and sometimes it was river plains," says Greb. "It just kept cycling through time."

A Fuel Gauge in the Sand

The coal fields where Greb and Archer met may now benefit from their river research. Greb met Archer, who at the time worked with the Indiana Geological Survey, during a field trip in Indiana in 1989.

By trading sandstone images electronically on the Internet and sharing ideas through long-distance phone calls, these two researchers aren't discouraged by the 800 miles between them. "We try to meet in person several times a year, but with e-mail and next-day mail the distance really doesn't matter," Greb says.

"In fact, in some ways the distance helps.

Kentucky was a
tropical paradise
300 million years
ago. According to
widely accepted
scientific models,
Kentucky was on the
equator.

In geology it's very easy to get too focused on your own backyard. When you work with someone who is in another state or even another country, that person is being exposed to different research, which often helps to test hypotheses you may take for granted or to put your own work in a different light.

"A very significant application to our river system research is the ability to predict the location of oil, natural gas, water and coal in similar sandstone deposits," says Greb.

Some of the ancient river sands were very porous, filled with tiny holes that held oil, natural gas and water. For industries that rely on underground core drilling, knowing where these sands are located within the ancient Kentucky valleys will eliminate hit-and-miss drilling in other valleys. "Drilling cores is very expensive, so you can't just keep drilling holes into the ground hoping you'll come up with oil or water or natural gas," Greb says. "If you find a spot with oil or natural gas, knowing the probable pattern of these resource-rich sands in the valley will tell you where to put your next hole."

Greb and Archer's findings about these oil-rich sands have attracted international interest. "Many countries have similar valleys, but in other countries these types of

deposits exist thousands of feet beneath the surface, where the only information geologists can get about the sands are from core samples, often spaced kilometers apart," Greb says. To find out what happens between these points, geologists need to find a similar sandstone exposed at the surface, where they can measure changes in sandstone layers. "Because the quartz-pebbled sandstones are so easily accessible in Kentucky, geologists from other countries can learn about details of the sandstones from our naturally occurring outcrops at the surface and apply that information below ground in other parts of the world," Greb says.

For the coal industry in Kentucky, Greb and Archer's research can tell where coal won't be found. "These sands filled valleys that cut through coal-bearing rocks," Greb says. "In the future when we concentrate more on the deep underground coals, we can warn mine planners where these sands are and where the coal is not." Greb says knowing where these sands are also has safety applications for underground mining. "Some of these sandstones are very hard — the spaces between grains and quartz pebbles were filled with natural cement," he says. "If you're in a coal mine and that's your roof, it's very hard to drill holes for support bolts."

Beyond the fuel benefits, this research could impact global warming theories. "Understanding how the ancient climates changed in response to rising sea level has important implications for predicting what might happen if global warming is a reality and global sea levels continue to rise," Archer says. "We certainly don't understand how climate has varied over time and how it is changing today. There is quite a bit of conjecture in some of the more dire predictions of global climate change that is not necessarily supported by the available data. Studies like ours might help clear the air a bit."

One thing is clear: the ancient sandstones hold secrets to Kentucky's past as well as keys to the future. The picture Greb and Archer have painted of these great rivers reveals new questions for scientists exploring climate and fresh opportunities for energy resources on a global scale. ☐

New UK Dean Eager to Meet Challenges of Graduate Education

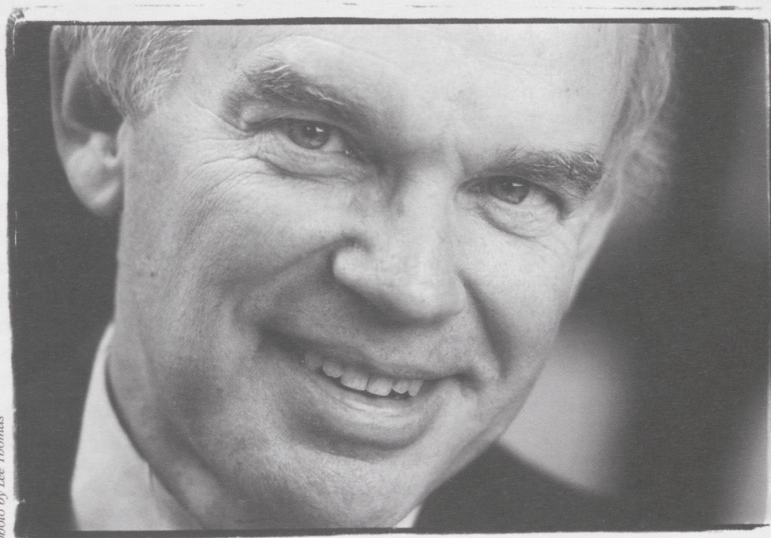


photo by Lee Thomas

MIKE NIETZEL SAYS, "WE HAVE TO MAKE SURE THE GRADUATE STUDENTS WE EDUCATE HERE ARE A DIVERSE GROUP. WE'VE MADE PROGRESS BUT STILL HAVEN'T DONE AS MUCH AS WE NEED TO."

When asked what he thinks of his new job as dean of The Graduate School, Mike Nietzel says that in a sense there's nothing new about it. He's doing what he's done for years at UK: helping to educate and train graduate students.

"What appealed to me most as a professor of psychology was working with graduate students, mentoring them," says Nietzel, who had been psychology department chairman since 1991. "And now as dean of The Graduate School, I have a chance to work with grad students on a broader scale."

Nietzel replaced Dan Reedy, who has returned to teaching in the Department of Spanish and Italian. A search committee unanimously recommended Nietzel for the position after considering 72 candidates and conducting interviews with four finalists.

The Iowa native earned his bachelor's

degree in psychology from Wheaton College (in Wheaton, Illinois) and his master's and doctoral degrees in psychology from the University of Illinois. Nietzel has written several books and published 75 scholarly articles in the areas of clinical psychology, forensic psychology and jury decision-making.

Although he says it's too early to totally assess how he feels about his new position, Nietzel admits to the shattering of one preconceived notion of the job. "I thought I'd have more time to reflect on decisions and issues than I do," he says. "A lot of decisions have to be made quickly. Things come up you just can't plan ahead for."

Nietzel believes his biggest challenge as Graduate School dean is to keep faculty, administration and students focused on the

goal of assuring that UK achieves the highest standards in graduate education and research, then finding resources which allow the University to meet this goal.

Another related challenge is the question of diversity. "We have to make sure the graduate students we educate here are a diverse group. We've made progress but still haven't done as much as we need to," Nietzel says. "We need more fellowship support for programs like the Lyman T. Johnson Fellowship, support that will make us competitive with the echelon of universities we want to be moving into." He adds that this imperative calls for fellowship funds for graduate students to be doubled or tripled.

Nietzel says that it's important to emphasize that the next few years at UK are critical as far as responding to the challenge of

WRITTEN BY
JEFF WORLEY

CONTINUED ON PAGE 22

SPOTLIGHT ON GRADUATE EDUCATION

becoming a stronger university in the areas of research and graduate studies. His ongoing participation on the Research and Graduate Education Task Force, which President Charles T. Wethington Jr. formed to identify programs on which to focus as UK pursues top research status, is one of the ways Nietzel is responding to this challenge.

He adds that he is involved in a series of initiatives to make UK more competitive in recruiting top graduate students.

"We've started a new program called Visiting Distinguished Faculty, whereby about 15 programs a year will be awarded travel funds and an honorarium to bring a nationally recognized leader to campus to serve as a Graduate School outside examiner for a student's dissertation. "The dissertation must be an excellent piece of work. The visiting scholar will also give a research colloquium while he or she is here." Nietzel says that this initiative will make leading scholars outside of the university more familiar with the excellent research being done here, and it will also enrich the intellectual atmosphere here.

"This approach is modeled after what Canadian and European universities have been doing for years — the outside member of the dissertation committee comes from

outside the university altogether," Nietzel explains. He adds that faculty will be responsible for identifying the very best of the 240 dissertations completed each year at UK.

The university's new graduate dean is also working to substantially increase funding for graduate students' work. "We should be providing funding for students whose dissertation work has to be on-site. We want to provide more funds for travel when a student's research necessarily takes her off campus," says Nietzel, who adds that he expects to be able to also fund some graduate students to go to national or international conferences to present their research.

"By internally re-allocating some money, we're also looking at converting a number of one-time fellowships to multi-year fellowships, which we hope to fund for 12 months at \$15,000 each," he says. "This is a significant change and should help us attract a number of top-notch graduate students."

Nietzel adds that for these various initiatives to be successful, there's "obviously a need" for donations and private endowments.

Perhaps the greatest challenge for gradu-

ate education at UK, he says, is preparing graduate students for the job market. "But we're doing what we can. With programs like Preparing Future Faculty, we're trying to make students as flexible and as well-prepared as possible for a diversity of job markets. That's probably our best strategy right now." Nietzel says that educators simply don't have any real firm understanding of how soft or firm job markets are right now. "There are projections, of course, but some of these have totally reversed within the same decade. I'm skeptical of our ability to forecast these things."

In his new role as Graduate School dean, Nietzel says he's extremely fortunate to be able to seek out the counsel of former Graduate School dean Dan Reedy, who spent 13 years as head of The Graduate School. "Dan's always been as generous as he can be with his advice and opinions," Nietzel says, "but he also realizes that on some issues I'll come to different conclusions than he would." With Nietzel's track record as a teacher, researcher and administrator, Reedy says that his replacement is an excellent choice to take The Graduate School into the next millennium. ■

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WRITTEN BY
ALICIA P. GREGORY

CHARLES YOUNANS,

M.S. Education, '48, D.Ed., Education and Mathematics, '55, is a retired project manager of employee development and training for IBM in Lexington, a position he held for 16 years. Before World War II, Youmans served as director of vocational education for the Fayette County Schools. During the war, he was employed by Tenn-Eastman Corporation as supervisor of employee training for work on the Manhattan Project. Youmans, an assistant professor of vocational education teacher training in the UK College of Education for three years, now lives in Rochester, Minnesota.

AUTUMN GRUBB

(FORMERLY GRUBB-SWETNAM),

Ph.D., Telecommunications, '84, is a distance-learning faculty member and coordinator of professional development at Georgia College and State University in Milledgeville. After coordinating a successful distance-learning program at Morehead State University in Kentucky between 1995 and 1997, Grubb launched Innovative Learning Group, an on-line business to train distance learning faculty, with her partner Peggy Hines. In March, Grubb and Hines were keynote speakers for two conferences in South Carolina on faculty training



and instructional tools on the World Wide Web. Grubb's e-mail address is <agrubb@rocketmail.com>.

JANIE OLMSTEAD HEAD,

M.S., Guidance and Counseling, '68, is owner of Images Model and Talent Agency in Lexington and a former Miss Kentucky. She received the Lifetime Achievement Award and was inducted into the Modeling Hall of Fame by the



International Modeling and Talent Association (IMTA) in New York City in July 1997. Images received International Modeling School of the Year designation from IMTA in 1994, 1995, and 1996.

SAMUEL V. BELL,

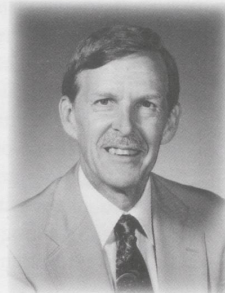
Ph.D., Electrical Engineering, '77, is an emeritus professor of electrical engineering at the University of Louisville. Bell was a faculty member at U of L for 31 years and spent 21 years in the U.S. Navy. During active duty, Bell held key positions for installation, operation, maintenance, and test evaluation of guided missile systems. He also consulted on installation of a statewide emergency medical communications system in Kentucky. Bell was inducted into the Casey County Hall of Fame in May 1997 along with UK President Charles T. Wethington Jr. and former Governor Wallace Wilkinson.

GORDON DEJONG,

M.A., Sociology, '60, Ph.D., Sociology, '63, won the 1997 W. LaMarr Kopp International Achievement Award. DeJong, distinguished professor of sociology and director of the graduate program in demography, received this award for his significant contribution to Penn State's international mission. A Penn State faculty member for 33 years, DeJong's demographic research has been a magnet

for both domestic and international students. The graduate program he founded in 1987 is one of the largest graduate training programs in demography in the United States.

DeJong has conducted research in Peru, England, Holland, Israel, the Philippines, Thailand, and Romania. He has written a book and nearly two dozen professional articles co-authored with Third World scholars. DeJong is a senior fellow at the U.S. State Department's East-West Center in Hawaii and editor of the Population Association of America journal *Demography*.



WENDY H. BALDWIN,

Ph.D., Sociology, '73, received the 1997 National Public Service Award, cosponsored by the American Society for Public Administration and the National Academy of Public Administration, for her accomplishments in science administration. As NIH deputy director for extramural research for the past three years, Baldwin streamlined administrative processes for receiving, reviewing, awarding, and monitoring the \$8.5 million in grants and cooperative agreements NIH awards annually to support scientific programs. Her leadership earned the program a National Performance Re-



continued
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GRADUATE ALUMNI ACHIEVEMENTS

view "reinvention laboratory" designation under Vice President Al Gore. Baldwin serves internationally as a U.S. representative in the World Health Organization and the Human Frontiers of Science Program (a consortium of industrial nations supporting biomedical research). She also chairs the World Health Organization steering committee on social science research on reproductive health.

WENDIE CORBIN OLD,

M.S., Library Science, '69, is the children's librarian at the Fallston/Jarrettsville branch



of the Hartford County Public Library in Maryland. Her book *Marian Wright Edelman: Fighting for Children's Rights* received the CBC/NCSS award for Notable Children's Trade Book in the Field

of Social Studies in 1996. She has published six books and several magazine articles for children. She and her husband, Francis E. Old III (*M.S., College of Library Science, '69*), each have more than 30 years' experience as librarians. Francis is the internetworking manager at the Baltimore County Public Library.

Pauline Rose Clance,

Ph.D., Clinical Psychology, '69, has been a professor of psychology at Georgia State University in Atlanta for 23 years and in private practice in clinical psychology for 27 years. Her research has included body image and gender issues, feminist therapy, women and barriers to success, and services for HIV-positive individuals. Clance authored *The Impostor Phenomenon: Overcoming the Fear That Haunts Your Success* and has appeared on "Donahue," "The

Today Show," and "Nightline" among other regional and national radio and television programs to discuss this book. She is a national and international lecturer, president of the Southeastern Psychological Association, and listed in *Who's Who in the World*. Clance is currently a faculty member of the Gestalt Institute of Georgia and an associate editor for *Gestalt Review*.

JOHN W. STEINLAGE,

M.B.A., Business, '73, is currently the vice president of finance and chief financial officer for STA Travel, Inc., a division of the London-based STA Travel Group, in Los Angeles, California. He has led the company from loss to profit and was influential in doubling the branch network. In 1995, Steinlage was awarded the CMA (Certified Management Accountant) designation by the Institute of Management Accountants. He has lived in the Los Angeles area since graduation from UK and was assistant treasurer for the Los Angeles Olympic Organizing Committee for the 1984 Los Angeles Olympic Games.



Olivia Wright,

M.D., Medicine, '90, works as the only doctor in Durham, Connecticut. She settled there last March after work around the world which included searching for the cause of a deadly virus on Irian Jaya, the Indonesian half of New Guinea known for its history of headhunting, and running a hospital on an Aborigine reservation in Australia. Wright says she discovered the job in

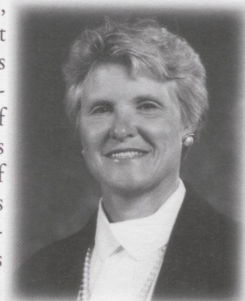
Durham through the Internet advertisement placed by Middlesex Hospital while she was in Australia and, wanting to put down roots, she moved back to the United States. Wright now teaches at the hospital once a week and runs her one-woman practice four days a week. She is a native of Irvine, Kentucky.

JAMES HOECKER,

Ph.D., History, '75, was appointed Federal Energy Regulatory Commission (FERC) chairman by President Bill Clinton in June 1997. In addition to private practice, Hoecker, who also holds a law degree from the University of Wisconsin, has served as FERC assistant general counsel and as a staff advisor to commissioners Matthew Holden and Georgianna Sheldon. When he took office in 1993, Hoecker was the first FERC commissioner to have once served on the FERC staff.

VALERIE MACLEOD,

M.S., Library and Information Sciences, '76, was promoted to vice president for Strategic Alliances at UMI, The Answer Company, in July 1997. UMI collects, organizes, and delivers information (including periodicals, newspapers, business journals, and broadcast transcripts) to customers in businesses, universities, libraries, and schools in more than 160 countries. MacLeod has worked at UMI since 1976, and her recent past positions included director of corporate sales and head of DataTimes sales. As Strategic Alliances vice president,



GRADUATE ALUMNI ACHIEVEMENTS

she is responsible for working with publishers and collaborating with information providers worldwide to distribute UMT's content to corporate libraries.

PATTI BAZEL GEIL,

M.S., Clinical Nutrition, '80, is currently a diabetes nutrition educator at the University of Kentucky Chandler Medical Center. Geil served as a pediatric endocrine nutritionist at UK from 1977 to 1987, and she was nutrition coordinator for the metabolic research group at the UK College of Medicine from 1987 to 1994. Geil was named as a fellow of the American Dietetic Association in 1995



and received a Community Service Award from the Bluegrass District of the Kentucky Dietetic Association in 1996. Geil recently published two best-selling cookbooks, *Magic Beans* and *The White House Cookbook*, and is working on two additional cookbooks for people with diabetes.

LAWRENCE J. RAY,

M.A., Counseling Psychology, '71, is chief of staff at Massachusetts General Hospital Cancer Center and vice president for clinical program development at Dana Farber Cancer Center, both in Boston. Ray retired from the National Institutes of Health and received the NIH Director's Award in 1996. His wife Rose Ray (M.A., College of Education, '71) is an assistant professor in special education at Boston University.

RICHARD BURR II,

J.D., Law, '76, was a member of Timothy McVeigh's defense team. Burr and his wife Mandy Welch were both defense lawyers for McVeigh, who was sentenced to die for the Oklahoma City bombing. Burr has made mentally ill inmates a particular cause, in several cases persuading the U.S. Supreme Court that defendants who have become insane should not be put to death. He has had a varied legal career that included being litigation director for the Texas Appellate Practice and Education Resource Center, assistant counsel for the NAACP Legal Defense and Educational Fund, along with private practice and work in the public defender's office in West Palm Beach, Florida.

IVAN B. LISS,

M.A., Education, '63, was appointed dean of Radford University's College of Arts and Sciences in May 1997. A Radford faculty member since 1985, Liss has been professor and chair of the computer science department and director of academic computing services. As associate dean from 1993 to 1996, he chaired a committee that developed the college's long-range strategic plan. Liss served as interim dean in the 1996-97 school year.

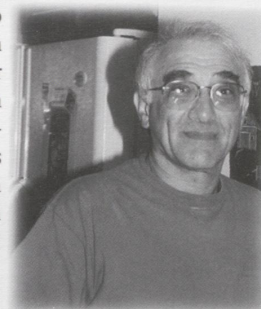
AUDREY TAYSE HAYNES,

M.S., Social Work, '85, was named as deputy assistant to the president and director of the White House Office for Women's Initiatives and Outreach by President Bill Clinton on August 28, 1997. Haynes, of Frankfort, Kentucky, formerly served as deputy secretary of the Cabinet for Health Services for the Commonwealth of Kentucky, chief of staff for Lieutenant governor Stephen L. Henry, and as an advisor to Governor Paul Patton. In 1986, she was appointed director of

human resource development for the Kentucky Department of Mental Health and Mental Retardation. From 1989 to 1993, Haynes was the executive director of the Kentucky Literacy Commission and from 1993 to 1996, she served as executive director of Business and Professional Women/USA and the Business Professional Women's Foundation in Washington, D.C.

HERBERT HIRSCH,

Ph.D., Political Science, '68, is currently a professor of political science at Virginia Commonwealth University in Richmond, Virginia. He is the author of seven books, including *Genocide and the Politics of Memory* (1995). Hirsch is on the board of the International Institute on the Holocaust and Genocide. He gave a seminar for policy planning staff at the U.S. Department of State in 1992, has lectured abroad in Australia, England, and Germany, and was selected as one of 30 scholars to participate in the Goldner Symposium on Post-Holocaust Ethics at Wroxton College in Oxfordshire, England.



KIOSK

WORKING TO STOP THE SPONGING OF THOROUGHBREDS

Someone is pushing sponges far into the nostrils of thoroughbreds at one of the nation's leading racetracks, endangering the animals' lives and sullyng the image of thoroughbred racing. No one knows who is doing this or why. There's speculation that the culprit — someone with easy access to horses in the track's stable area — is angry at the racetrack and is seeking revenge, but so far the "sponger" hasn't been found.

After investigative efforts failed to catch the person who placed sponges in the

nasal passages of eight horses at Louisville's Churchill Downs in the summer of 1996, the state's racing commission turned to UK's Gluck Equine Research Center for help. Robert Holland, a veterinarian and UK veterinary science doctoral student, was asked to develop a pre-race test that would detect the dangerous nasal obstructions. Holland's research on equine respiratory diseases and experience as a racetrack veterinarian for the racing commission made him the logical choice as key researcher.

"The commission wanted a noninvasive, quick test that would not irritate the horse," says Holland, a Maryland native who rode horses in his youth. "It had to be something that two people could run because of the staff situation at the racing commission." The test also had to be ready in six months so it could be used to screen horses in the prep races for the Kentucky Derby and for the Derby itself. "The commission wanted to protect the integrity of racing and were concerned about the situation," Holland says.

Holland told the commission that endoscopy, a test in which a thin tube is inserted into a horse's nostril, was the best way to check for obstructions. But horsemen were concerned scoping would irritate horses, spread infections and possibly injure the animals.

At a veterinary conference in Colorado, Holland found a company eager to help him with the project — Anesco, Inc., a manufacturer of veterinary anesthesia equipment located just minutes from Lexington in Georgetown, Kentucky. By March, the researchers had built and thoroughly tested the Airflow Measuring Meter, a device that fit all of the com-

mission's requirements. Using the meter, the researchers could test a horse in about one minute. Made from anesthesia equipment used for humans, the meter cost the commission only \$3,000.

According to Thomas Tobin, a Gluck Center veterinarian and faculty member who helped evaluate the meter, the device did not irritate horses in the least. "It was not a problem at all," he says. "It was not uncomfortable because it was not invasive."

The meter, which looks like a gas mask, has cups that fit over each of the horse's nostrils. When a horse exhales, air from each nostril flows through hoses and is measured and compared. If there is a disparity, the horse is checked more thoroughly.

Throughout the spring racing season, the test was used on hundreds of horses, and there were no sponging incidents. Then, about a month after the Derby, the culprit foiled the meter by placing two identical sponges in a horse's breathing passage. The news was terribly discouraging to Holland and others who had worked on the project.

"In the end, we found that two sponges were more difficult to detect," says Holland.



DEMONSTRATING THE DEVICE WHICH MEASURES AIRFLOW OUTPUT IN RACEHORSES ARE (FROM LEFT) JOHN ENGLE, PRESIDENT OF ANESCO INC.; ROB HOLLAND, A VETERINARY SCIENCE DOCTORAL STUDENT AT THE GLUCK EQUINE RESEARCH CENTER; WYNDEE CARTER, ANIMAL TECHNICIAN, AND TOM TOBIN, PROFESSOR OF VETERINARY SCIENCE, BOTH AT THE CENTER.

Photo by Bill Mesner

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1997-1998 UNIVERSITY RESEARCH PROFESSORS

But at the same time, the good news was that the presence of the airflow meter forced the sponger to change his tactics.

"The FBI was pleased because it made the person change his method," says Holland. "Placing a sponge up a horse's nose is hard but placing two is harder, takes more time and is easier to detect with an endoscope." Since that incident, the racing commission has been using endoscopy for its pre-race testing. "I had told them that endoscopy is the only way to definitely know," Holland says.

By developing the meter for use before the Derby, the center helped prevent an incident that could have seriously damaged the image of one of the state's most vital and visible industries, an industry that employs from 80,000 to 90,000 people.

"The racing industry benefited greatly from our work," says Tobin. "If the integrity of racing is brought into question, it could have a negative impact on the industry." The project was just one example of the ways in which "the center works closely with the industry to help find technological solutions to problems," says Tobin.

—Vickie Mitchell

Three faculty members were named University Research Professors for 1997-98 by the UK Board of Trustees. They are Dennis Clouthier, chemistry; Mark Summers, history; and Mark Mattson, anatomy and neurobiology.

The research professorships were established in 1977 to recognize outstanding research achievement and to enhance and encourage further scholarly research productivity. Recipients use the \$30,000 award to cover their research-related expenses and their teaching duties so they may devote themselves to full-time research activities for a year.

Dennis Clouthier, a native of The Pas, Manitoba, Canada, and graduate of the University of Saskatchewan, came to UK in 1984. During his Research Professorship, Clouthier will focus on two new reactive intermediates that were discovered in his lab. "Reactive intermediates are short-lived fragments of molecules formed during chemical reactions," Clouthier says. He uses high-powered lasers to analyze these transient molecules.

Studies of reactive intermediates may hold the key

to improving the chemical purity of computer chips. "The chemical processes used in making computer chips are poorly understood," he says. "Many of the computer chips that are grown cannot be used because they have chemical contamination, so there's a huge research effort going on all over the world to try to figure out how the chemical processes work at the very elementary level so we can improve efficiency."

The September 8, 1997, issue of *Chemical & Engineering News* featured Clouthier's current research on the rare property called quantum beating exhibited by his two new molecules. Molecules with this characteristic get rid of the energy they absorb from a flash of laser light in an oscillating or beating pattern.

Mark Summers holds degrees from Yale and the University of California, Berkeley, and joined the UK history faculty in 1984. Summers is the author of four books, all published by major university presses. His most recent book, *The Press Gang*, analyzes the connection between journalism and politics in the Gilded Age, the last three decades of the

19th century, which were characterized by a greatly expanding economy.

During his year as a Research Professor, Summers will continue to focus on the Gilded Age in his next book, *The Owner's Manual*. Summers says the name of the book reflects the true owners of America's political system — the politicians. "By making decisions, or in fact by doing nothing, politicians have completely changed the condition of people's lives," Summers says. "This book will study how politics actually worked in the period of 1870 to 1900 America."

The Owner's Manual will reveal many of the dirty campaign tactics Summers found in researching UK's 19th-century newspaper collection. "It's unbelievable what tactics you find. One candidate very successfully cut down his opponent's votes by suggesting that his opponent was dead five or six days before the election," he says.

Mark Mattson, a native of Rochester, Minnesota, came to UK in 1989. He holds degrees from Iowa State University, North Texas State University, and the University of Iowa. Mattson's research on Alzheimer's disease is currently focused on a

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UK BIOLOGIST NAMED PRESIDENT OF BOTANICAL SOCIETY OF AMERICA

mutated gene that causes an inherited form of the disease that strikes early, sometimes when people are in their late 30s.

This inherited gene disrupts the nerve cell's ability to regulate calcium and increases production of free radicals, unstable molecules that damage cell proteins. Mattson's study, featured in the June 1, 1997, issue of *The Journal of Neuroscience*, has shown that nerve cell death caused by these genes could be delayed by treating cells with drugs that block calcium and exposing them to vitamin E, an antioxidant that neutralizes free radicals.

"The value of studying these inherited forms of Alzheimer's disease is that the cause is known, whereas in 85 to 95 percent of all Alzheimer's cases, the cause is not known and cannot be explained by a genetic mutation," Mattson says. "But there seems to be a final common denominator in both inherited and non-genetic forms of Alzheimer's disease that excessive calcium and free radicals cause nerve cell death."

—Alicia P. Gregory

University of Kentucky biology professor Carol Baskin was named president of the Botanical Society of America for 1998. Baskin, who spent fall semester as a visiting scientist at the Swedish University of Agricultural Sciences in Uppsala, Sweden, will begin her duties as president in August 1998 at the annual meeting in Baltimore, Maryland. A society member since 1968, she served as secretary from 1980 to 1984 and program director from 1990 to 1996.

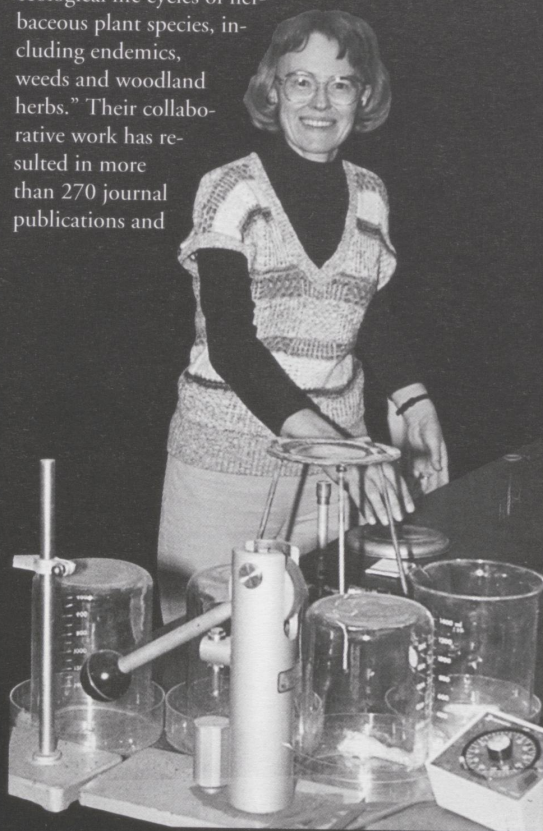
"I believe that all scientists benefit from being active in a professional organization, and the Botanical Society of America has been an important part of my life for many years," Baskin says. "The society has given me the opportunity to present my research to my peers, meet and get to know people in my field, and learn how to do many new things, such as organize a program for a large national meeting. I feel that being president is a way to say thank you for all the society has done for me."

Baskin has been a UK faculty member for 25 years and has done much

of her work in collaboration with her husband, Jerry Baskin, who is also a professor with the Thomas Hunt Morgan School of Biological Sciences. "Jerry and I were married in Nashville, Tennessee, on August 12, 1968, and arrived at UK three days later," Baskin says. "In our research, we have been mainly concerned with the ecological life cycles of herbaceous plant species, including endemics, weeds and woodland herbs." Their collaborative work has resulted in more than 270 journal publications and

a book titled *Seed Dormancy and Germination: Ecology, Biogeography and Evolution*.

—Alicia P. Gregory



HISTORY GRADS PAY TRIBUTE TO CHARLES ROLAND

A professor can never really predict how much influence he will have on his students. Take University of Kentucky graduates John David Smith and Thomas Appleton, for example. Both attest to the "positive and enriching" influence of a history professor they had at UK, and the two have now organized a tribute for their mentor.

Smith and Appleton recently edited *A Mythic Land Apart: Reassessing Southerners and Their History*, a book of essays written by proteges of retired University of Kentucky history professor Charles Roland. Seven of the nine contributors studied under Roland during his tenure at UK from 1970 to 1988.

Smith remembers Roland as a top-notch teacher who was demanding and meticulous. "When I was a graduate student here, Dr. Roland made me rewrite the first chapter of my dissertation six times," Smith says. "He had extremely high standards of exposition."

Smith, a history professor at North Carolina State University, says having to work up to such exacting standards made him a better scholar. Roland, he says, was tough, but fair and has maintained ties with a number of his former students. "Tom Appleton and I wanted to do

it because of our affection for Roland," Smith says. Because of his intimate knowledge of Roland's high expectations for writing, Smith "wanted to be sure this book was as well written as it could be."

The essays, while scholarly in nature, are generally written in straight, clear, readable prose. Appleton says they made a deliberate effort to make a book that would be readable outside the community of professional historians.

Appleton, who is publications editor for the Kentucky Historical Society and an adjunct history professor at UK, says when he first studied under Roland, "I questioned whether I could cut it or not." But, Appleton says, Roland was a great mentor. Appleton and Smith solicited papers from Roland's former students, and from the responses selected the nine original essays that appear in the book.

Both Smith and Appleton pointed to Carol Reardon's essay, "Robert E. Lee's Military Legacy," as one of the book's most noteworthy, partly because it refers directly to some of Roland's scholarship. Reardon, now a history professor at Penn State

University, says, "Charlie is one of the biggest names in Civil War history. To be a Roland student is something special." She says while he was exacting, he could be engaging as well.

Likening his lecture style to that of a southern preacher, Reardon says, "he could hold a large lecture class absolutely spell-bound." Reardon, who, like Roland, has done extensive work with military history, says she was glad to contribute to the book. "I would've been really upset if I couldn't have been a part of it."

Roland says that when he heard about the book, "I was highly pleased and gratified." He chuckled when he heard about his students referring to his demanding nature as an instructor. What he was doing, he says, was trying to get them to perform to their potential. "I needed to induce, cajole, agitate, or, if necessary, force them to come up to the level of their own capacity."

He says when it came to his graduate students, he wanted to push them to find and develop their own voices intellectually. "I took the attitude that I was not going to try to force them into any mold. I didn't

have to agree with them in order to direct them. They could reach their own conclusions," he says.

One of the conclusions Roland's students seem to have reached is that, as Reardon says, "This was a labor of love for all of us."

— **Graham Shelby**

ELK MAKING A COMEBACK IN KENTUCKY

After nearly 200 years away, elk are returning to Kentucky.

A group of 200 transplanted elk were released into Eastern Kentucky forests this past winter, and scientists are there to see if these animals can adjust to the place where herds of elk once roamed.

University of Kentucky conservation biology professor Dave Maehr says changes inflicted upon the natural landscape by humans in the 18th and 19th centuries also drove animals like the elk, the black bear and the red wolf out of the Bluegrass. "During that time we lost a lot of species in Kentucky," he says. Elk herds disappeared by 1800 and the last elk in the state was officially spotted in 1850.

Elk remained in the West and are still commonly found in the Rocky Mountain states. The Kentucky Department of Fish and Wildlife Resources is involved in having elk captured and shipped in from Utah in hopes of repatriating them to their former habitat.

Maehr says the project will provide wildlife researchers with "an understanding of what this

expatriated species will do in an area where it once used to live."

To monitor how the elk fare in this old "ancestral" environment, some of the animals will be fitted with high-tech electronic tracking devices. The devices will be hooked up to a satellite system to enable scientists, from their offices, to monitor the animals via computer.

Maehr says it is important to know what happens to each of the animals in the first group of arrivals so that the Fish and Wildlife Resources group can make adjustments to enhance the survival chances of the subsequent arrivals. "We're looking very closely at that first 200," he says.

Ultimately, the project's goal is to return about 1,800 elk to Kentucky within the next nine years. Maehr says large numbers of animals are needed because elk are herd animals and because of the possibility that some of the initial transplants won't survive. "There's a certain amount of stress involved for the animals," he says. "They're being transported a long distance, from Utah. The terrain will be different from what they're used to,

as will the kinds of grass and shrubs they like to eat."

While the animals will be fighting to survive in their new surroundings, Maehr says anyone who wanders into the path of a foraging elk doesn't need to worry — they're not fearsome animals. "You don't hear horror stories about elk attacking joggers," he says. "They're nothing for people to fear."

The goal of the transplant is to create a permanent, breeding, huntable, and "viewable" population of elk. If the project is successful, he says, it could lead to other

animals returning to their former Kentucky habitats.

"This may be the beginning of some more interesting restorations that may involve other species down the road," he says.

Kentucky's elk restoration program, which is expected to take nine years to complete, will be the largest ever attempted in the eastern United States.

— **Graham Shelby**

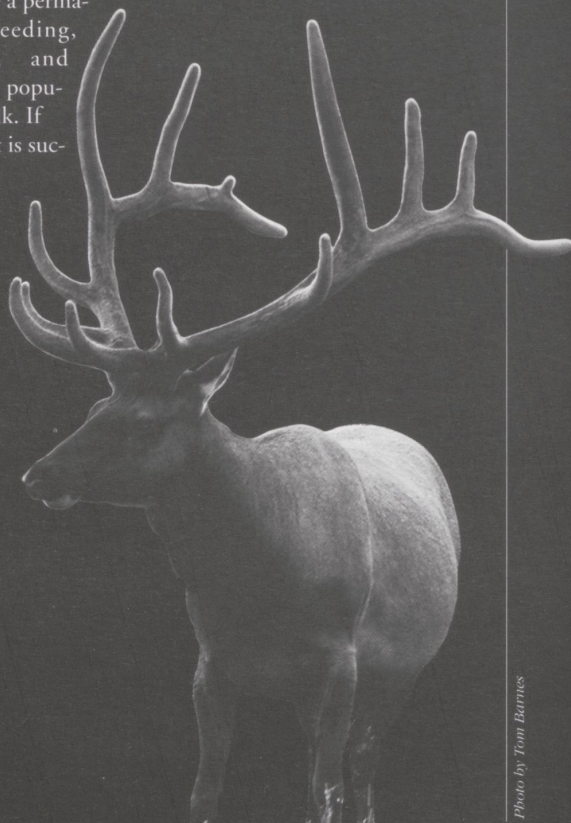


Photo by Tom Barnes

CENTER FOR RURAL HEALTH WINS NATIONAL AWARD

The University of Kentucky's Center for Rural Health in Hazard received a prestigious national award for its educational work to relieve the chronic shortage of health-care personnel in the state's rural areas.

"This award puts a whole new light on the center," says Wayne Myers, the center's director, who accepted the 1997 Primary Care Achievement Award and \$5,000 prize from the Pew Health Professions Commission in San Francisco last September. "We didn't set out to be the top in the country, we just tried to come up with a good approach to address health-care distribution problems."

The rural health center, created by state legislation in 1990, targets health-care delivery problems in Kentucky by recruiting and training rural, "place-committed" students to participate in several health profession education programs, including a family practice residency, as well as nurse practitioner, physical therapy, and clinical laboratory sciences programs. Another center effort is the Kentucky Homeplace Project, begun three years ago, which trains rural women to act as health advi-

sors and information sources for their neighbors.

Today, 85 percent of the center's graduates are living and working in rural areas, and 78 percent of them are in rural Kentucky. "There's no magic to these numbers," Myers says. "We simply train rural people in rural areas to do rural jobs and it's working. In this day when there is an absolute surplus of most health workers, a program isn't worthwhile unless it helps trained people go where they are needed."

The Center for Rural Health seeks to instill a sense of community responsibility in its students through projects like the Community Initiated Decision Making program, which aims to strengthen ties between communities and their local health-care systems and educate residents about the significance of health care to local economic development. "If rural health care gets better, people will use it more," Myers says. "And if people use rural care instead of driving into town, that keeps dollars and jobs in the community."

The Center for Rural Health plans to use the \$5,000 award to support a

statewide study of health-care workforce needs. "We will invite people from UK and other universities, and provider and consumer organizations across the state to help with this study which will look at the distribution of health workers across the state to determine where additional training programs may be needed," Myers says.

—Alicia P. Gregory

WELFARE REFORM: IS IT WORKING?

What better way to understand welfare reform than meet face-to-face with those who will live with the effects of this reform?

That was the philosophy of a team of researchers from four areas at UK as they undertook a study of welfare reform in Lexington. Team members were Claudia Peck-Heath, associate dean of the College of Human Environmental Sciences; Jo Ann Ewalt, a doctoral candidate in the Martin School of Public Policy and Administration; Mary Secret, an assistant professor of social work; and Teri Wood, director of the Survey Research Center. (Wood has since left the university to

serve as epidemiologist with the Kentucky Department for Public Health.)

The team developed a survey and oversaw interviews with 173 welfare recipients during the summer of 1997. The initial survey, on the heels of the implementation of welfare reform last July, will be the baseline for a long-term study of the effects of reform on the well-being of welfare recipients and their families. The team hopes to survey participants annually.

Ninety-eight percent of the respondents were women, 50 percent were African American and 47 percent were white. The average age was 30, and the average number of children was two.

Preliminary results of the survey indicate that though most respondents are confident they'll find work, they are pessimistic about others in the same situation. Sixty-two percent believe they will be able to get a job that will pay well. However, only 16 percent feel that other recipients will find jobs.

"Welfare, as we have historically known it, is gone. Recipients must 'transition' into employment,"

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says Peck-Heath. "It could be respondents are internalizing this message. Though they are personally able to cope with this change by perceiving an optimistic outlook for themselves, they may, down deep, feel the real dilemma that welfare reform presents for them. They may then express that apprehension by indicating less anticipated success for others." Peck-Heath says this is an example of the complex nature of welfare reform.

The survey found that 43 percent of the respondents are currently employed and 17 percent hold more than one job. Of those working, 88 percent make between \$4 and \$7 per hour.

Of those not employed, 32 percent said going to school is the main reason they aren't working, and 27 percent said taking care of home and/or family is the main reason. Very few pointed to barriers such as cost or availability of child care or transportation, or being unable to find work or not having qualifications for work, as the main reason for not working.

The timing of the initial survey was critical to the project's success.

"We needed to get the data collected quickly," says

Secret. "If we didn't get it collected before the full impact of welfare reform hits, we wouldn't have a baseline."

The interviewers—mainly university graduate students—used laptop computers in their interviews and spent about 45 minutes in each home, asking questions from a survey of more than 300 potential questions.

The survey measured whether basic needs like medical and child care were being met. It also touched potentially sensitive areas—whether welfare recipients had other sources of income, how family members might have helped them and barriers to employment they faced.

The research team believes the survey will help government officials develop policies related to welfare reform.

"This research has real-world applications," says Peck-Heath. Ewalt agrees. "We definitely feel that policy implications are one of the outcomes, particularly on issues like child care."

—Vickie Mitchell

NEW AFRICAN-AMERICAN STUDIES DIRECTOR TO EXPAND PROGRAM

On the wall of Gerald Smith's 17th-floor office in the Patterson Office Tower hangs a letter of rejection from the University of Kentucky Graduate School. "I keep it there to keep me grounded," he says.

"As an undergraduate I worked at Roger's Restaurant down on Broadway and then at Sears selling shoes and maintenance agreements," Smith says. "I didn't have a high GPA, had low GRE scores and was denied admission to the graduate program. But I knew I wanted to get a Ph.D. in African-American history and teach at the college level." And UK history professors Steve Channing and George Wright knew Smith could do it if the university would give him a chance. "They convinced The Graduate School to accept me on probation, which meant I could only take a limited number of hours and had to get a certain GPA, and, as they say, the rest is history," Smith says.

After earning his master's and doctorate from UK, Smith taught American history here from 1986 to 1988 before leaving to teach African-American history at Memphis State University (now the University of Memphis). He returned here in 1993, and now teaches African-American history. In mid-July of last year, almost 20 years to the day he came to UK as a freshman, Smith was appointed director of the African-American Studies and Research Program.

The program, which began in 1992 and currently has 10 minors, offers a 21-hour, multidisciplinary minor. "I'm concerned about selling this program to students and getting more students involved," Smith says. Community involvement is a top priority for Smith, who grew up in Lexington on Chestnut and Breckenridge streets and is the associate minister at the Consolidated Baptist Church. "I'm going to be looking at adding independent courses to our curriculum that will allow students to take the knowledge they're learning in African-American Studies and apply it in the community, working with an agency, library or community organization.

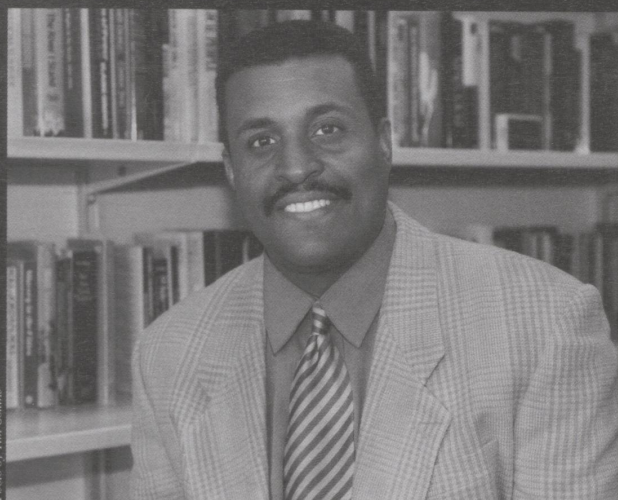


Photo by Tim Collins

Smith says enhancing the research arm of the program is his current focus. "In effect, the research in the African-American Studies and Research Program has existed in name only up to this point," he says. "I want to bring some credibility to that, not only in terms of the kinds of courses we develop, but specifically in terms of the kind of research we support." Smith's vision is to create a Center for the Study of Civil Rights which would provide graduate- and professional-level research opportunities for UK students. "From a program standpoint, my goal is to create a major in African-American Studies," Smith says. "This will take time, and it will

take commitment not only from university administration but from faculty and students."

Smith has agreed to serve as program director for two years. "The reason I did that was that I'm very much engaged in my own scholarship," he says. "Right now I'm co-authoring a book on race relations in Memphis, Tennessee, from 1862 through 1923, and I'm researching a book on the civil rights movement in Kentucky." His first book, *A Black Educator in the Segregated South: Kentucky's Rufus B. Atwood*, was published in 1994.

Smith credits his love of history with a number of events in his childhood.

"When I think about the root cause of my interest, when I was four years old my mother worked as a secretary in a funeral home. She kept me during the day so I became fascinated with the young men I saw lying in caskets in uniform who were killed during the Vietnam War. I wanted to know what kind of a life these people lived," he says. Smith also credits the Daniel Boone TV show and the set of encyclopedias his parents bought him with feeding his curiosity.

"History provides a framework for each of us to understand people with different cultural backgrounds," Smith says. "And the African-American Studies Program seeks to promote knowledge of one of those cultures, the African experience, through quality teaching and research."

—Alicia P. Gregory

FRAZIER NAMED TEACHER OF THE YEAR FOR OUTREACH EFFORTS

"Nothing melts your heart more than driving up to a school you've never been to before in your life, and stuck in the big chain-link fence are Styrofoam cups that spell out 'Welcome Dr. Frazier.'" From elementary students to national organizations, Don Frazier has received many kinds of recognition for his educational outreach efforts. In April, the American Physiological Society named him the Arthur C. Guyton Teacher of the Year for 1997.

The Teacher of the Year award, which is sponsored by the W. B. Saunders Company and includes a cash award of \$1,000, is given for documented excellence in teaching both in and out of the classroom, and for a demonstrated commitment to physiology education.

"This award recognizes the work of a lot of dedicated people – staff, volunteers and students – who have supported this

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program," says Frazier, professor of physiology at the University of Kentucky College of Medicine and director of the UK Medical Center's Outreach Center for Science and Health Career Opportunities.

"I think the award was a consequence of the impact the Outreach Center has had not only in Kentucky, but nationally. When people see that you're reaching 10,000 to 20,000 kids annually, they also see that you have the opportunity to make a very positive impact on the future of science education," Frazier says.

The Outreach Center, which opened in 1993, coordinates educational programs designed to stimulate interest in the sciences and encourage pre-college and undergraduate students to pursue science and health-related careers. The bottom-line goal of the outreach center is linking those "doing science" in the UK Medical Center with students and teachers throughout the state and beyond.

The Outreach Center's Science Hotline, which began at UK in 1991, was the first program of its kind in the nation to connect Kentucky teachers, parents and

students with UK professors and researchers. "Some days we get no calls, other days we get four or five; but in the spring around science-fair time the phone really starts ringing," Frazier says. "Imagine you're a classroom teacher trying to help 30 or 40 kids come up with ideas for science projects. You're going to yell 'Help!'" Students around the state call the hotline (1-800-955-9500) with science questions on topics ranging from physics and astronomy to agriculture.

"The hotline knows no boundaries," Frazier says. "We take their name, phone number and question, and I'll take that information all over campus until I find someone who can help. We don't do homework for them, but we are here to offer guidance and refer kids to resources in their area to help them find answers to their questions." Teachers also use the hotline to schedule visits to the Outreach Center or line up scientists to visit their schools.

Through these center visits, where students can be hooked up to a polygraph machine, and mobile classroom visits around the state where Frazier unpacks his collection of human organs for students to hold, science becomes tangible.

"Our primary message is one of scientific literacy," Frazier says. "I'm absolutely amazed when I ask a young person where a hairdryer or a vacuum cleaner or a carburetor comes from and they think that's not science. They perceive a scientist as some weird person with a crazy hairdo and

thick glasses in a research laboratory. We show them that's really not what science is. When they start to realize science is important in all of our growth and development economically, science becomes a subject for everybody."

—Alicia P. Gregory

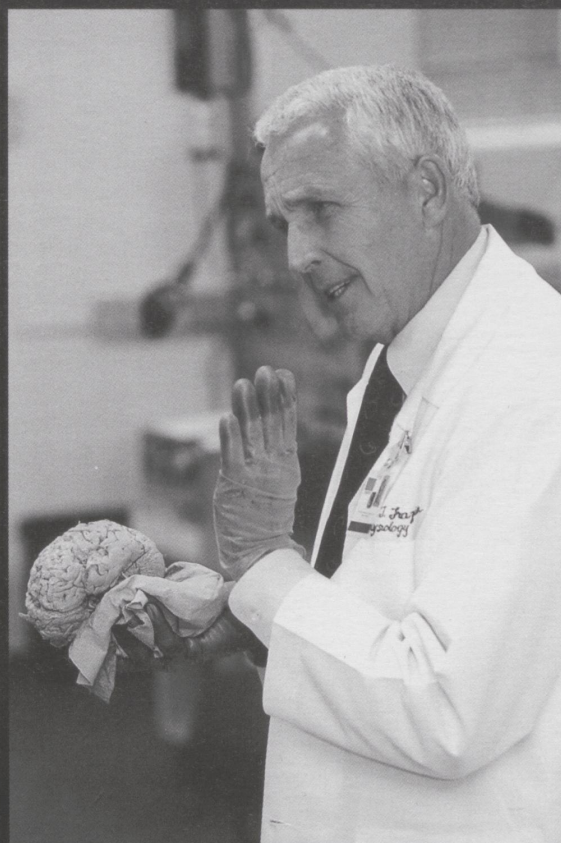


Photo by Michelle P. Thomas, Lexington Herald-Leader

CAN TAMOXIFEN PREVENT BREAST CANCER?

Last October the first group of women in a University of Kentucky breast cancer prevention study stopped taking their pills — the 20-milligram dose of tamoxifen or a placebo that had become part of their daily routine for the past five years. In the next few years the commitment of these women will reveal if tamoxifen, a drug used to treat breast cancer since 1971, can prevent the disease. “The goal is to see if, over time, there are fewer cases of breast cancer in the women who are taking the tamoxifen pill,” says Edward Romond, principle investigator for this study and a UK associate professor of medicine.

Researchers have known for a long time that estrogen plays an active role in tumor cell growth. The hormone binds to molecules, called estrogen receptors, in the tumor cell and nourishes the cell. Tamoxifen, the chemical look alike of estrogen, will also bind to these same estrogen receptors, but it starves the tumor cell instead of feeding it.

The 13,389 women involved in this national study, including more than 150 women at UK, are at an extremely high risk of developing breast cancer. Researchers judged each woman’s cancer risk to determine eligibility for the study based on factors such as age, onset of menstruation and menopause, history of biopsies, and history of cancer in her family.

One of the challenges this study has faced is negative publicity about the potentially serious side effects of tamoxifen. Among the risks are hot flashes, rapid pulse, and a one in 600 chance of developing uterine cancer. “Anytime you break new ground, you always have to deal with criticism,” Romond says. “We received very sharp criticism for including younger women in our study. The press ignored the fact that

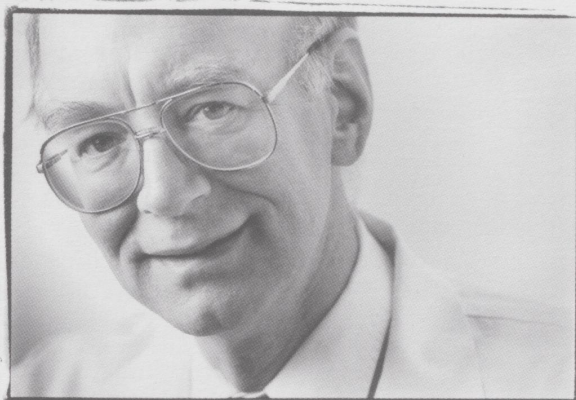


photo by Lee Thomas

EDWARD ROMOND

we’re not treating every 35-year-old woman, and that the only 35-year-olds we included had a more than 50 percent risk of developing breast cancer.

“It comes down to a risk-benefit issue. There are few interventions in medicine that are totally without risk,” Romond says. “The side effects and risks of tamoxifen were known long before the study started, and we explained these issues to women in great detail, because we wanted people to go in with their eyes open.”

Naomi Hume, who joined the trial in September of last year, says, “Life is a risk. Whatever potential side-effects might come with tamoxifen are worth the risk to me if I can help prevent breast cancer not only for myself but for other women.”

While some women in the study have experienced minor side effects and have stopped taking the medication, Rita Munn, assistant professor of medicine and a member of the tamoxifen study, says every woman who took or is still taking the drug will be checked every six months for several years for breast cancer and to find out if the problem the woman was reporting went away after she stopped taking tamoxifen.

Since the trial began in 1993, both Romond and Munn have been impressed

with the dedication of the women involved in the study. “You can only learn so much about cancer in the laboratory, and that can’t translate into practice without women such as these — the credit belongs to them,” Romond says.

Munn adds, “Women have been very committed to the study, and part of their motivation is to change the impact of breast cancer for all women, not just for themselves and their families.”

Davis L. Gardner, who is coming to the end of her five years in the study, says, “There’s never been any doubt that I was important as

who I am, and that I was not just another subject in the study. I can’t emphasize enough the importance of people participating in trials such as this whenever they have the opportunity. Whether or not tamoxifen is found to be effective in preventing breast cancer, this study has increased awareness of breast cancer, and the knowledge gained through this trial will contribute greatly to future research.”

Romond anticipates he and colleagues across the nation will be ready to analyze the results of this landmark study by the year 2000. “Up to this point, we have spent all of our energy trying to take care of breast cancer after the fact. This is the first study to try to do something before the fact,” Romond says. “I would much rather prevent breast cancer than have to treat it. Wouldn’t it be great if 200 years from now, breast cancer didn’t exist on Earth? This could be the first step.”

An article on this UK tamoxifen study first appeared in the Winter/Spring 1993 issue of ODYSSEY.

ODYSSEY

RESEARCH OUTREACH

The University of Kentucky's research goal 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. *ODYSSEY*, through articles about various research projects and graduate research programs, reflects the breadth of the university's search for new knowledge and the myriad of research endeavors under way.

Research Impacts You

ODYSSEY is not just a magazine — it is a resource which serves as the basis for some very important outreach activities. The articles appearing in *ODYSSEY* are rewritten — in a briefer format — for a newspaper column titled "UK Science & You." This column is sent to every newspaper in Kentucky and is a regular feature of many of the weekly papers. Through these columns we reach a potential audience of 1.4 million readers—letting them know how UK research impacts their daily lives.

ODYSSEY is published twice a year and distributed free of charge to graduate alumni and friends of the University of Kentucky. *ODYSSEY* is not financed by the state general fund.



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PARTING SHOTS

"If you think education is expensive, try ignorance."

—Derek Bok, president emeritus of Harvard University

"When you take stuff from one author, it's plagiarism; if you take it from many writers, it's research."

—Wilson Mizner, U.S. playwright (1873-1933)

"An essential aspect of creativity is not being afraid to fail."

—Edwin Land, U.S. inventor and founder of Polaroid (1909-1991)

"Education is not the filling of a pail, but the lighting of a fire."

—W.B. Yeats, Irish poet and dramatist (1865-1939)

"The human mind treats a new idea the way the body treats a strange protein; it rejects it."

—Peter Medawar, British zoologist (1915-1987)

"Human history becomes more and more a race between education and catastrophe."

—H.G. Wells, English novelist and historian (1866-1946)

"Don't worry about people stealing your ideas. If your ideas are any good, you'll have to ram them down people's throats."

—Howard Aiken, Harvard professor who designed the first digital computer (1900-1973)

"Mistakes are the portals of discovery."

—James Joyce, Irish novelist (1882-1941)

"If all the students who slept through lectures were laid end to end, they'd all be a lot more comfortable."

—Unknown

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Quartz Pebbles Reveal Ancient River System in Appalachia, p. 17*

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