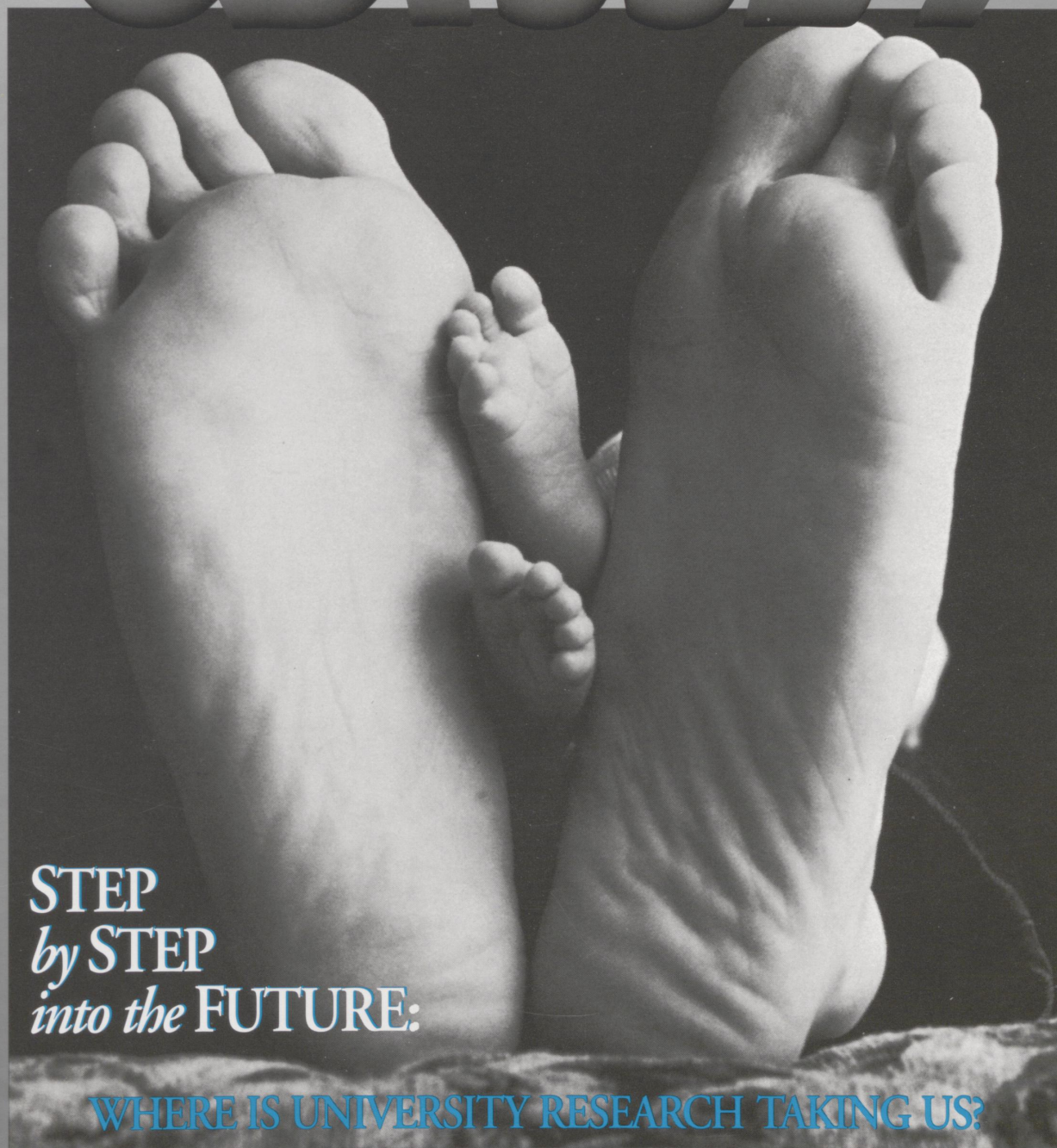


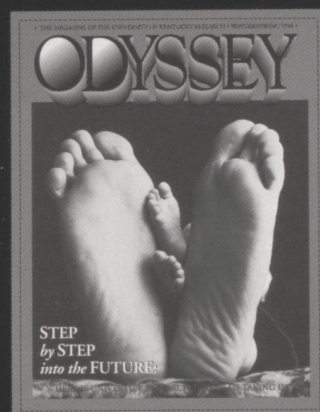
• THE MAGAZINE OF UNIVERSITY OF KENTUCKY RESEARCH • WINTER/SPRING 1996 •

ODYSSEY



STEP
by STEP
into the FUTURE:

WHERE IS UNIVERSITY RESEARCH TAKING US?



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

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

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

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

F E A T U R E S

**GROWING OLD
IN THE NEW MILLENNIUM**

6

What will it be like to be 80, 90, 100 years old in the decades to come? UK researchers agree on this: It's going to be challenging.

EXPLORING CYBERSPACE

13

The extension of technology into cyberspace has just begun. Read how researchers are booting up for the long journeys ahead.

**STEP BY STEP INTO THE FUTURE:
WHERE IS UNIVERSITY RESEARCH
TAKING US?**

27

A dozen or more UK researchers make their best guesses about the role of current research and its potential effect on the near and not-so-near future. What will it be like to be alive in the year 2050?

**SYNERGIZING RESEARCH
TO SOLVE HEALTH PROBLEMS**

38

Based on the premise that the whole can be greater than the sum of its parts, a new research facility at UK supports the synthesis of knowledge on pressing health problems.

UPDATE

43

Has the allure of leisure time slowed down UK's Joseph Kuc now that he's retired? No, retirement has hardly even been a speed bump.

D E P A R T M E N T S

LETTERS

4

*Comments from
our readers*

**HONORABLE
MENTION**

21

*Impact and Achievements of UK
Graduate Program Alumni*

KIOSK:

40

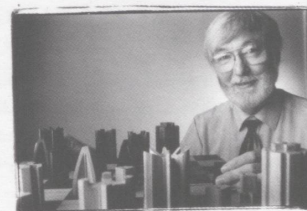
*UK's Martin School Ranked
a Winner
Rye Gone Awry?
New VP for Research Arrives
and more....*



KIOSK, P. 40



**STEP BY STEP INTO THE FUTURE:
WHERE IS UNIVERSITY RESEARCH
TAKING US? P. 27**



**THE LEXINGTON
OF THE FUTURE, P. 32**

©1995 University of Kentucky.
All rights reserved.
Cover photo by ©Jeff Illcomb,
Liaison International

rec'd 1/5/1996

ODYSSEY

Editor

Susan Hodgetts Stempel

Associate Editor

Jeff Worley

Designer

Shear & Shear

Production Manager

Lisa D. Lizer

President

University of Kentucky

Charles Wethington, Jr.

Vice President for Research and Graduate Studies
Fitzgerald Bramwell

UK

University of Kentucky

WINTER / SPRING 1996
Volume XIII, No. 2

Odyssey is published twice a year by the University of Kentucky, Research and Graduate Studies Office of Communications & Advancement, Kinkead Hall, Lexington, KY 40506-0057. Copyright 1995 by the University of Kentucky. All rights reserved. *Odyssey* is distributed free of charge to graduate alumni and friends of the University of Kentucky. Voluntary subscription donations to support the magazine may be sent to the above address. Each issue of *Odyssey* describes only a few of the many University of Kentucky research projects under way in a variety of areas. Requests for permission to reprint material are welcome and should be sent to the Editor, Communications & Advancement, University of Kentucky, Lexington 40506-0057 (phone 606/257-8297; fax: 606-257-8298; or e-mail <odyssey@pop.uky.edu>.) The publication of *Odyssey* is not financed by the state general fund.

We admit it: This is an exciting issue for us at *Odyssey* Magazine for several reasons. First of all, we've gotten a facelift that has resulted in a friendlier layout and organization. We hope that these surgical changes will make reading *Odyssey* more enjoyable for you.

Part of our excitement is admittedly personal. When we undertook the major job of redesigning the magazine back in April, we didn't know that our designer, Teresa Shear, would be having a baby just about the time we needed her most. And at that time Teresa didn't know either. We also didn't know that Lisa Lizer, our production manager, would be well under way with her second child, who is expected on Christmas Day. Last spring, Lisa was also unaware of the upcoming event. So it has turned out to be an interesting and, most literally, productive summer and fall, with Lilly Elaine Shear now settled on her family's farm, along with her sisters Grace and Hannah, and we are anticipating the arrival of Lisa's second child shortly. Certainly the future that several UK researchers talk about in this issue will impact this new generation, as well as many of our readers' children and grandchildren.

As to the new format for *Odyssey*, the change most relevant to you as a reader is the addition of a Letters column. This section will open up the opportunity for us to hear what you like about the magazine, what you don't like, and any thoughts you might have related to the articles in *Odyssey*.

Another reason we are excited about this issue is that unlike our usual lineup of articles which typically features a variety of unrelated research projects from around the campus, this issue is organized on the theme of the upcoming millennium and how our research efforts may manifest themselves by the year 2050. It has been a challenge to address the subject, as well as a fascinating imaginative journey into the future.

I have never been a particularly future-oriented person. In fact, Alvin Toffler's phrase in *Future Shock*, something to the effect of "being dragged kicking and screaming into the future," could certainly have been applied to me as a young woman in the early '70s. But now that the twentieth century is coming to a close, I find myself happily ensconced and looking toward the year 2000 with curiosity and some eagerness. Tackling the subject of the future in this issue of *Odyssey* has only enhanced that feeling for me.

It is hard not to be excited about the possibilities for the future when you hear some of our researchers talk about what they're doing, for example, in

ODYSSEY

ODYSSEY

gene therapy research and where that research may lead. In the article titled "Where Is University Research Leading Us?," we hear of the promise for great advances in the treatment of cancer and about the gene therapy work under way at UK; and in this same article we see the tremendous promise of John Thompson's research. Thompson has developed a new drug at UK that may become the definitive drug for increasing patient survival for organ transplant operations in the future.

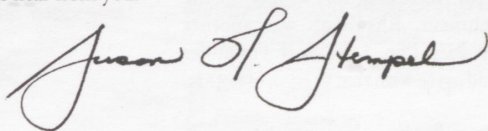
In the article on cyberspace you will read about some incredible applications of computer technology that are happening today. With UK's good fortune to have top-notch computer facilities, our researchers are using some technology that, to most of us, is mind-boggling. One researcher, for example, while sitting at his computer workstation on the 5th floor of the Center for Robotics and Manufacturing, is developing computer turbulence simulations for high-speed jet planes. UK researchers in physics and astronomy are using the computer to create large-scale models of the universe to try answer the ancient and ultimate questions about how the universe was constructed. Still other UK researchers are exploring ways to push our computing abilities even further—to see the limits of how much information the computer can simultaneously read and interpret. The results of this work will enrich and simplify our lives.

In this issue you'll also read what it might be like to grow old in the 21st century. Will we become old in a world like that depicted in the movie "Blade Runner," where foul air and gloom permeate the streets? Will we live in a world populated by cyborgs and humans—each unrecognizable from the other? Or is Toffler's 1970 concept of utopian colonies, based on the technology and society of tomorrow, a more accurate picture of how our culture might evolve?

The research under way in our universities today may well be one of the best indicators of what the future holds. As social psychologist Warren Bennis said of the future, "No exaggeration, no hyperbole, no outrage can realistically describe the extent and pace of change . . . In fact, only the exaggerations appear to be true."

Indeed, future change is hurtling toward us. And while French poet and philosopher Paul Valéry's statement that "The future is not what it used to be" is ironically right on target, through some of the research under way today, the future may turn out to be a very user-friendly place to be. I line up behind the hope suggested by H. Rosovsky in *The University*—"Research is an expression of faith in the possibility of progress."

Read, enjoy, and let us hear from you.



LETTERS

ODYSSEY



More on Viet Nam

I was delighted to read the article entitled "What Were We Doing in Vietnam?" in the Summer/Fall 1995 issue of *Odyssey*. I have long been a student of the Vietnam War, and like those featured in the article, I, too, was attracted to UK because of the reputation of Professor George Herring.

Robert Topmiller's view of the siege of Khe Sanh particularly got my attention. Topmiller refers to this unpleasantness as "the 1967-69 Siege," but he later dates its duration as 77 days and beginning on 1 January, 1968. Mightn't he better call it "the 1968 Siege" instead? In any case, the siege began with a relatively minor artillery attack commencing between 0500 and 0530 hours on 21 January, and not on 1 January.

Topmiller says that during this initial engagement the Khe Sanh Combat Base "was hit hard by rocket attacks." The attack consisted of approximately 100 82mm mortar shells and 60 122mm rockets. By Khe Sanh standards, this attack was more akin to a light summer drizzle than the fierce thunderstorms of enemy fire that later rained down upon the base.

Topmiller is exactly right when he describes the serious consequences of this initial attack. The subsequent cooking off of munitions in the Marines' main ammunition dump, including CS antipersonnel gas and C-4 plastic explosives, continued well into the daylight hours.

Topmiller seems to claim that 2,000 Americans died in this initial fighting ("We lost 2,000 of our 6,000 men in

that battle"). His figure approximates the total official Marine Corps casualty figures (killed, wounded not requiring evacuation, wounded requiring evacuation, missing in action) for the entire 77-day siege. I see the events surrounding Khe Sanh as a series of battles that, taken together, constitute the siege. On this point perhaps it is the case that I am confused by Topmiller's interchangeable use of the words "battle" and "siege."

Topmiller believes that it would have been tactically sound for the PAVN forces surrounding Khe Sanh to continue the assault begun that day and seize the base. However, no ground assaults of any significance were launched against the combat base on the first day of the siege. North Vietnamese Minister of Defense Vo Nguyen Giap claims that taking the Khe Sanh Combat Base was never his intention anyway. According to Giap, it was all only a ruse.

Perhaps Topmiller will agree with me that if Giap's claim is credible, Khe Sanh was a diversion of the highest magnitude. Giap fooled me, too.

Today there isn't much at Khe Sanh to remind anyone of the fighting there, only an unimpressive monument proclaiming the liberation of the Khe Sanh by the Vietnamese Communists from the Americans and the Saigon puppet troops. According to the text on the monument, Khe Sanh was another Dien Bien Phu. I doubt if Topmiller would agree with that version of events.

*Peter Brush
graduate student
UK School of Library
and Information Sciences*

Response from Robert Topmiller:

Mr. Brush is correct when he points out that the official beginning of the siege of Khe Sanh was January 21, 1968. I remember that date very well because I was wounded later that day during a mortar attack. One could argue, however, that Khe Sanh was part of a larger struggle between the North Vietnamese Army and the U.S. Marine Corps for control of the northwest corner of South Vietnam that started with the hill fights of May 1967. Certainly significant combat took place around Khe Sanh in the weeks before the siege began. I also want to apologize for my use of imprecise language in describing the casualty figures. I never meant to imply that 2,000 men died at Khe Sanh. By "lost," I meant killed, wounded and missing.

While Mr. Brush considers the opening attack at Khe Sanh as little more than a "light summer drizzle" compared to the later massive shelling, I would respond that I was at Khe Sanh from the beginning to the end of the siege and nothing ever had the impact on me as the shock of that first day. For many of us, that was our first exposure to combat and the horribly disfiguring nature of wounds caused by rockets, artillery and mortars. In addition, due to the explosion of the dump, we had to treat a number of men wounded by white phosphorus.

LETTERS

ODYSSEY

Pain and Pleasure

Every time I glance at the cover of the Summer/Fall 1995 issue of *Odyssey*, I wince with vicarious pain, but every time I read one of the research projects reported on the inside, I am fascinated and grow prouder and better informed in regard to our University and the research going on there.

I was a protester of the Vietnam War in the '60s and, therefore, had a special interest in the article by Sharon Reynolds, "What Were We Doing in Vietnam?" It is an eye-opening story of George Herring's work, *America's Longest War*, and his becoming mentor and guide for such remarkable graduate students as Robert Brigham, Mitchell Hall, Clarence Wyatt, Delia Pergande, and Robert Topmiller. Thus UK has become a magnet drawing those with continuing questions and controversies to be resolved.

Other articles in this issue are also interesting, important, and hopeful for the future.

Thank you for the "Honorable Mention" feature. I treasure the opportunity to learn of UK graduate program alumni. This issue introduces us to 12 men and nine women achievers, not a bad balance of the sexes, although I'm sure that was not your intention.

I wish to express my appreciation for the publication of *Odyssey*. Kentucky needs it! Please continue to let us know what wonderful things are happening here and now in our state.

Lorraine Lollis
Lexington, Kentucky

Kudos

Over the years my interest in the ongoing research projects at the University of Kentucky has remained constant; however, not until the advent of *Odyssey* has it been possible to stay abreast of such programs when one is not in close contact with the campus. I look forward to each issue of *Odyssey* and am convinced that it is one of the finest magazines of its type in the nation. Congratulations and may *Odyssey* remain a bright star in the University's communication constellation.

Frank G. Dickey
Lexington, Kentucky

Editor's note: *Dr. Dickey was the fifth president of the University of Kentucky. Appointed in 1956 at the age of 38, he served until 1963.*

The Value of Research

I really enjoy each issue of *Odyssey*. You cover a wide variety of research that is done at the University.

I want to encourage you to keep the Honorable Mention section. It is interesting to learn what graduate students do after they complete their degrees. This also lifts up the value of the research that is done at UK.

You are producing a well-written, attractive magazine. Thanks.

Ruth A. Kitchen
Lexington, Kentucky



Odyssey Magazine welcomes letters from our readers. Our address is: *Odyssey Magazine*, Kinkead Hall, University of Kentucky, Lexington, KY 40506-0057. Fax 606-257-8298. E-mail: odyssey@pop.uky.edu. Contributors should include their name, address, and daytime phone number. Letters are subject to editing for style and space limitations.

GROWING OLD IN THE NEW MILLENNIUM

How will the old in the U.S.—and our fastest-growing population segment, the oldest-old—fare as we move into the 21st century?

"How to live to be 100? Get to be 99. Then be very careful."

—ascribed to George Burns

If we take him at his word, George Burns these days is being very, *very* careful. Even though he recently cancelled, for health reasons, his long-booked 100th birthday show at Caesar's Palace in Las Vegas this coming January, Burns now has only a few weeks to go before hitting the magic century-mark.

Burns's longevity is obviously very unusual for his age cohort. The likelihood of anyone born in the last century living to be 100 years old is approximately the same as your probability of being blindfolded 20 feet away from a dartboard and throwing a bull's-eye. In 1900, average life expectancy from birth in the U.S. was only 47 years, in part because one in 10 babies did not live to their first birthday. And if you did manage to dodge a number of potentially fatal childhood diseases, your life expectancy rose only about four years.

The chances of living to a serviceable old age in our country are better now than at any previous time in history. American children born in 1990 have an average life expectancy of 75.4 years (women are ex-

WRITTEN BY
JEFF WORLEY
PHOTOS BY LEE THOMAS

pected to live 5.8 years longer than men). According to a recent demographic forecast in *American Demographics*, when these children turned one year older in 1991, their life expectancy was 76.2 years, because they had escaped the dangers of early infancy. And in contrast to survival rates of infants in the early part of the century, in the 1990s fewer than one infant in 100 dies before age one.

HOW LONG CAN WE EXPECT TO LIVE?

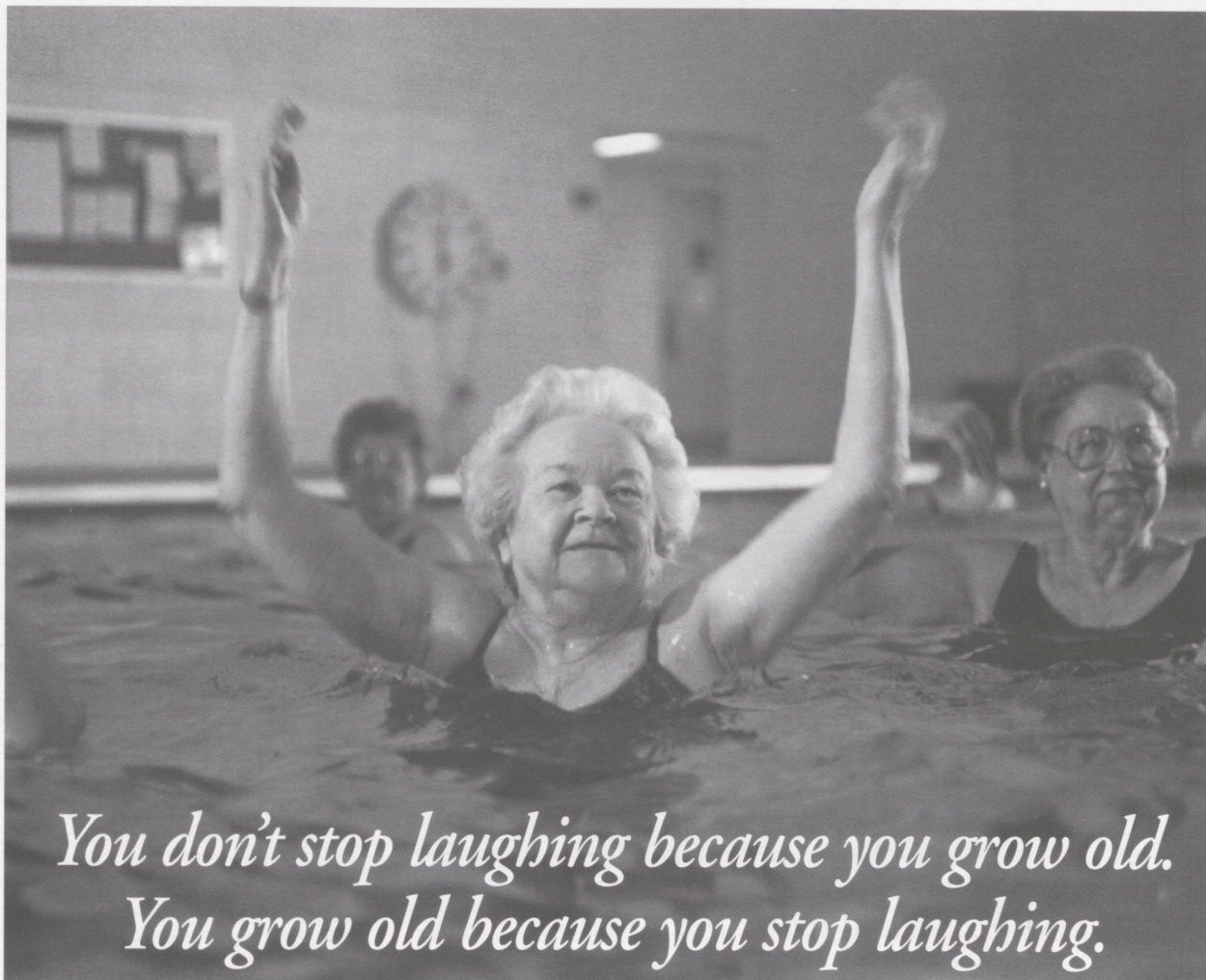
Researchers on aging, as well as all of us who want to live long, healthy lives, have taken an increasing interest in the limits of the human life span. Demographers are particularly interested in what will become of the baby boomer generation, those born between 1946 and 1960. Edward Schneider, who heads the Andrus Gerontology Center at the University of California, says that "If we do things right over the next few decades, at least half the baby boomers might expect to live into their late 80s and 90s."

"The baby boom population will hit 65 around the year 2010, and that will be a

massive group," says Graham Rowles, a gerontologist and associate director of the University of Kentucky's Sanders-Brown Center on Aging. "It's anybody's guess whether our social structures will be ready for this group—Social Security and our health-care system, for example. And this cohort will continue to be the largest age group until their children—the sons and daughters of the boomers—surge ahead in numbers around the year 2030."

Will the social structures in this country be ready to deal with the needs of such a large number of people? What effect will scientific and medical advances have on the human life span by that time? And more importantly, will living longer be worthwhile for our oldest citizens as their legions move into the new millennium?

"Knowing how long we are capable of living—our life span—and how long we are likely to live—our life expectancy—are important in a number of ways," says Rowles. "This information will, for example, influence strategies for combatting the diseases of old age, and will also allow us to estimate the future strain on social and medical programs that will be expected to take care of the growing numbers of old people in the U.S."



*You don't stop laughing because you grow old.
You grow old because you stop laughing.*

—Michael Pritchard

"Most gerontologists," Rowles continues, "would argue that there is a finite life span. And that the maximum any of us can expect, if our medical science does everything that it should and could, is that a very few of us will live about 120 years." A number of studies in the past 40 years corroborate Rowles's belief that no matter what we do to stay physically and mentally healthy, the best bodies of the species will fall apart at this hoary age like 20-year-old Yugos.

The limits of life expectancy, on the other hand, are not so seemingly fixed. In

a recent study, demographer S. Jay Olshansky and gerontologist Christine Cassel of the University of Chicago asked themselves by how much mortality rates would have to be reduced in order to push average life expectancy in the years ahead to the reachable 120-year human limit. What they found out, after doing some sophisticated number-crunching, is that even if science could eliminate heart disease and cancer—which now account for nearly 50 percent of all deaths in the U.S.—it's unlikely that the average life expectancy at birth would increase much beyond 85. One

of their findings that may surprise us is that if through various miracles of medicine and luck of avoiding accidents no one ever again died before reaching age 50 (thus eliminating more than 12 percent of all deaths), the increase in life expectancy would be only 3 1/2 years.

In taking a long-sighted look into the next century, John Thompson, an immunologist in UK's College of Medicine, believes that although a number of diseases that are common now will be under control or eradicated by the mid 21st century, life

continued on page 8

DALLAS HIGH: "I THINK WE'RE GOING TO SEE MORE AND MORE ELDERLY PEOPLE ADOPT A SECOND CAREER THAT BEGINS AT WHAT WOULD NOW BE CONSIDERED NORMAL RETIREMENT AGE."



"Unless there are some significant policy changes in this country in the near future, there may be a length of life that is worse than death."

—Dallas High

expectancy will increase "only about 15 years or so." And Thompson agrees with Rowles that the human life span seems to be stuck at about "115, 120 years." Our life span, he says, "has not gained a minute of time in the past 10,000 years."

Thompson cites a landmark study published over 35 years ago by anatomy professor Leonard Hayflick, who proved that normal human embryonic cells have a definitive lifespan. Hayflick grew cells in laboratory cultures under the most favorable conditions and found that after 50 doublings of the cells, they aged and died. "We showed that the death of cultured human cells was an inherent property of the

cells themselves," said Hayflick in a recent article titled "The Human Biology of Aging." "It was as if normal cells possessed a clock that determined how many times they would divide and function."

LENGTHENING OUR HEALTHSPAN

If the life span is relatively fixed but life expectancy is lengthening, our focus should be on making those additional years worth living, according to UK's Dallas High. "There's nothing wrong with adding years to life as long as we're adding life to years as well," says High, a professor in the philosophy department. "Quality-of-life issues should clearly be in the forefront of policy

issues in the years to come. Unless we pay more attention to issues of enriching the quality of life, which some gerontologists call our healthspan, I think we'll see more and more elderly people finding that these final years simply aren't worth living."

Rowles points out that this approach is particularly important given what he calls a "very depressing statistic" regarding older men. "Suicide rates for women tend to follow a fairly smooth bell curve throughout their lifetimes," Rowles explains. "They're very low in childhood, they peak around middle age, and then fall incrementally as a woman gets older. For men, it's different. At about age 65, a man's chances of taking his own life increase significantly; and the suicide rates shoot up for men over 85."

The right to die, choosing to do so, will be much more common and acceptable in the decades to come, High says. "Living wills and physician-assisted suicide will probably become commonplace," he says, "which is consistent with the high rate of suicide Graham mentions among older men." Though dismissing Kervorkian-style physician-assisted suicide as "not such a great model," High points to a recent voter referendum on physician-assisted suicide in Oregon that passed. Though the measure was challenged in court and ruled to be unconstitutional, High believes more such referendums will be passed by states and accepted in the courts.

Rowles agrees but also foresees a "scary part to this scenario."

While the elderly will be making a wider range of choice regarding how and when to make their final exit, Rowles underscores the tremendous responsibility of our future society to allow the elderly to make such decisions in the best possible health—physically and cognitively. "And here's what really worries me most about this," he says. "What if in the year 2050 you're very poor and can't afford, say, to have an operation

"Death is just a distant rumor to the young."—Andy Rooney

that might extend your life. Maybe physician-assisted suicide becomes the only choice left. I worry about a society that on the basis of economics will be selecting people out."

WORKING TOWARD A NEW CULTURE FOR THE OLD

Assuming that the vast majority of elderly choose to live as long as they can, what will our future hold for them? How and where will they live? How will they spend their final—perhaps many—years after retirement?

"The simple—and complex—answer is that we have to develop a whole new culture," Rowles says. "And we're in the process of doing it right now. We've got to develop a culture that is used to multi-generational families. We've got to think in terms of a culture where we've got old people caring for older people who are caring for even older people."

A common belief is that this is the way families used to be set up, so some might think that in developing such a multi-generational family model, we would be returning to past structures. "I call this idea the Myth of the Golden Age," says Laurie Hatch, an associate professor of sociology at UK whose research is focused in part on trying to understand the broad historical view of aging and the elderly in the U.S. "The myth is that modernization forever changed the status of the elders, that families no longer cared for their older members and abandoned them to their own resources, or placed them in institutions. The truth is, multi-generational households were the exception rather than the rule." In a recent forward-looking article titled "Family and Community: Changing Roles in an Aging Society," which appeared in *The Gerontologist*, researcher Marjorie Cantor states that a multi-generational family is a structure not of the past, but of the future. "By the year 2020," she says, "the typical family will

consist of at least four generations."

"My best guess is that by the year 2050, one major role for people 65 to, say, 85 years of age will be to take care of older family members," Rowles says, "and this 'age role' will be tied to the effects of siblings who leave home. You can already see today," he adds, "that when the family is dispersed, the person who takes care of Mom is the one family member that didn't get away." He says that the role of caregiving will take on new dimensions in the future as the population of the old and the oldest old (those 85 and over) continue to scatter geographically. "There are already some elder care programs in place that provide a national network of caregiving information. In the future, I envisage the development of caregiving cooperatives that span the nation. By being a member of such a cooperative and agreeing to take care of someone in the Lexington area, for example, I might get support for my mother in Utah," Rowles explains.

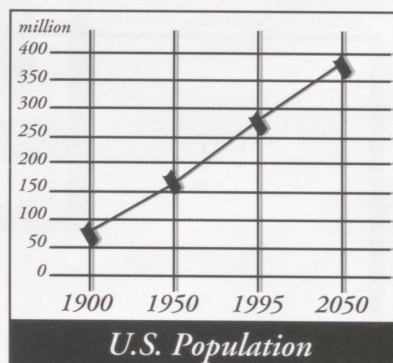
In addition to new forms of caregiving relationships, technology is likely to play an increasingly important role in the lives of older people during the next century. "Already, a variety of assisted living options are harnessing technological innovations in order to enable the increasing numbers of older people who live alone to maintain their independent living status," Rowles says. "With advances in robotics, it is quite conceivable that sophisticated robots and benign monitoring systems will become key elements in the lives of the frail elderly."

Another trend he and other demographers have continued to witness is the older generation separating themselves geographically in the U.S. In Alvin Toffler's *Future Shock*, which is now anything but shocking 25 years later, John Lofland, then of the University of Michigan, says, "There may come a day when some cities find that their politics revolve around the voting strength of various age [categories], in the same way

that Chicago politics has long revolved around ethnic and racial enclaves."

"Arizona already has 'elderly overlay zoning,'" Rowles says, "meaning that at least one member of the family has to be 55 years old or older to qualify to live in a designated area." Sun City, just outside of Phoenix, is one example where the effect of such a community has been dramatically felt, as Sun City residents kept voting down school bonds for the Peoria school district in which Sun City was located. The result was that the school district "excluded" Sun Citians from being taxed in matters regarding the school district.

"In the next century there are certain to be more and more naturally occurring retirement communities, or NORCs, as they're called," says Rowles. "And I'm not talking about Florida or Arizona; I'm talking about Wisconsin and Minnesota and



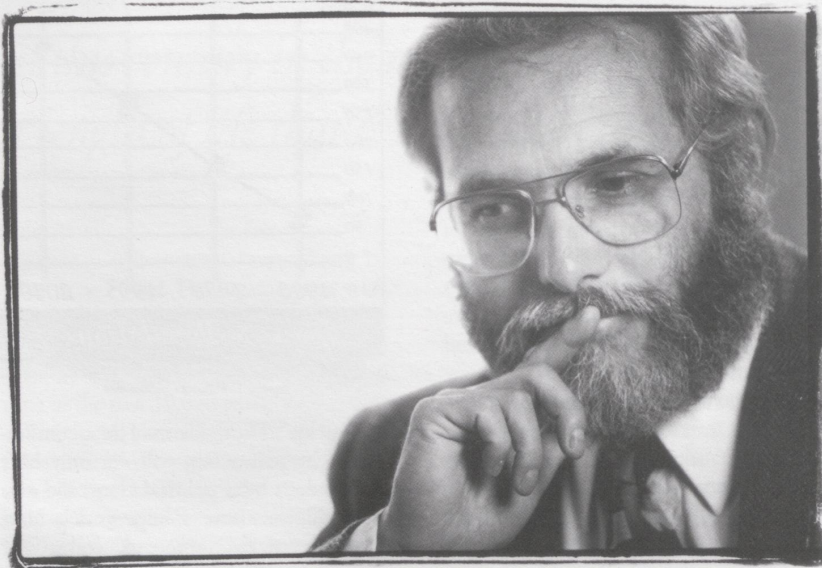
Source: U.S. Bureau of Statistics

Kentucky." The residents of these communities, he points out, will not only have tremendous local political clout; the over 55s will constitute a huge voting bloc. "There is now clearly more political activity among the elderly rather than less," High adds. "And as the numbers of elderly grow, they will determine even more the political direction of the country."

continued on page 10

"I can see a brave new world where decisions are planned or a horrible new world where decisions are arbitrary."

—Graham Rowles



GRAHAM ROWLES SAYS THAT IN THE YEAR 2030 THE POPULATION OF KENTUCKY IS PROJECTED TO BE 802,000, DOUBLE THE CURRENT NUMBER OF RESIDENTS IN THE STATE.

Stann Brunn, professor of geography at UK, believes that retirement communities of the future will also occur along lines of "shared professional interest"—military retirement communities, communities for specific religious groups and so forth. "Maybe even one here and there set up especially for teachers," Brunn says. "Who knows?"

In referring to his prediction that a major role for the old will be as caregivers in the family, Rowles gives one example of how political power in this group may manifest itself. "There are already arguments being made for tax breaks for middle-aged women who look after older people in their homes," Rowles says. "I think that kind of subsidy, that kind of support, is going to move up in aging groups in the next century. We may well be providing subsidies, for example, to 60- and 70-year-olds to provide support for 80- to 100-year-olds." High adds that, in

large part due to the lobbying impact of the American Association of Retired Persons, recent directives such as living wills and powers of attorney to reaffirm an individual's right to refuse medical treatment have already been put into place.

Though many older Americans will be working in the home as caregivers, High believes that as the population ages, people will also choose to stay on the job longer or to take up second careers at what we now think of as retirement age. "The traditional scenario—you're born, you're a child, become an adult, work until you're 60 or 65, spend a couple of years in retirement and then die—doesn't make sense any more given the physiological changes we've undergone in the past 60 years," High says. Although the prospect of 100-year-old CEOs, directors and deans may be far-fetched, not to mention a bit grisly, more and more Americans in the bloom of health at age 65 are deciding not to retire. "In the next few decades the prevailing retirement age (now around 60) will creep toward 70," says Richard Kirkland in a recent *Fortune* Magazine article, "as workers from necessity or fulfillment choose to remain in the labor force."

And what about those people in their 60s, 70s and 80s who, short of launching a second career, now appear in the workforce in paired-down roles at Traveler's Insurance and behind reservation desks at Day's Inns around the country?

"This is only a temporary expedient to our changing economics right now," Rowles says. "That's not what's going to be occurring in the year 2050 because basically the older generation won't let it happen. What this group will develop instead is a whole new role for people during that phase of their lives."

Ironically in the decades to come, a particularly dependable and competent group in the work force may be people over age

85. People who make it past 85 are a hearty group, says Richard Suzman of the National Institute on Aging. About 30 percent still live in the community and "are robust in the sense that they are able to lift shopping bags, walk half a mile and climb stairs."

And the most robust of this group may be African-Americans, according to Laurie Hatch. "Life expectancy for both black males and black females who reach 85 is greater than for white men and women," she explains. "The hypothesis is that if African Americans can live to be 85, they're particularly hearty because they've gone through, as a group, a severe trial living in a racist society." This pattern, says Hatch, is called the crossover effect in mortality.

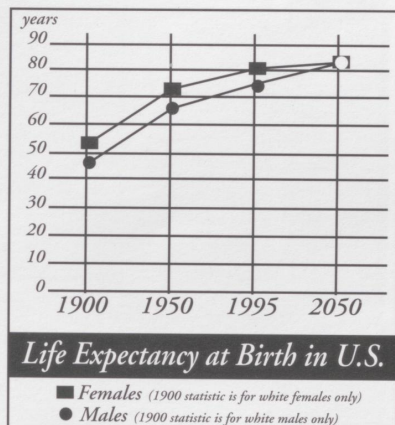
A FACELIFT FOR SOCIAL SECURITY

One of the major "transitions" in the way we think about older people, Rowles says, will involve a restructuring of our Social Security program. Developed in 1935, Social Security was meant to provide financial support for impoverished, vulnerable people 65 and over. "This made sense," Rowles says, "because in 1935 this group made up a relatively small proportion of the population. But now most people live to be 65 and are in good health at 65."

"One result of failing to restructure the Social Security system will be that an even greater gulf will widen between the haves and the have nots," High states. "My fear is that the group of people who have fared well under certain types of retirement systems won't grow nearly as much as the group of elderly poor, and that will lead to a greater disparity."

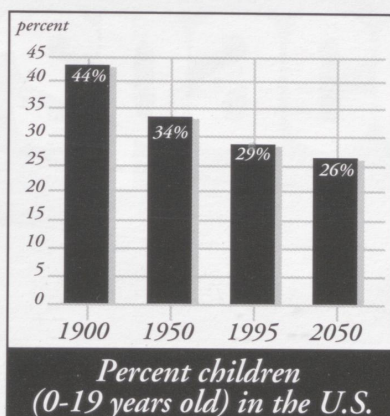
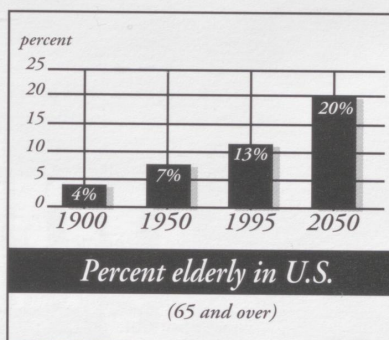
Kirkland's *Fortune* magazine article points out that if the Social Security system isn't revamped, as life expectancy rises toward 90 many Americans will spend almost as many years drawing a check from the gov-

continued on page 12



*By 2040
older people
will comprise
23% of the
total U.S.
population.*

—Marjorie Cantor



Source for statistics: U.S. Bureau of the Census

"The longer we live, the more urgent it will become to learn how to die."

—Richard Kirkland

ernment as they did working. The system would be clearly impractical, Kirkland argues, since even a conservative demographic forecast predicts that the number of workers per retiree will shrink from 3.3 to fewer than two after 2010.

THE ECONOMICS OF AGING

IN THE 21ST CENTURY

Rowles believes that the fate of thousands of old and oldest-old in our country will be held in the balance of two words: economic priority.

"It all comes down to dollars and cents," Rowles says. "If a new role is going to be created for our elderly, we're going to have to pay for it, whether it's tax credits for caregiving or health care for second careers. So much depends," he adds, "on how we frame the question. If we frame it in terms of economics—how much does it cost—then I think the future looks pretty grim. If we frame it in terms of what are we getting for the investment, then I'm optimistic."

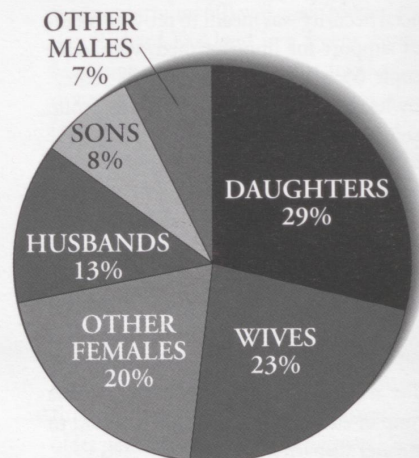
Rowles thinks his generation—he recently turned 49—is going to be pushing to extend the quality of life, to cherish the investment. "There are a lot of grandparents and great-grandparents alive today and leading productive lives because of technological and medical advances that simply cost money," he says. "Some of these people wouldn't have been alive 20 years ago, but we said, 'Yes, we're going to agree to pay for this.'"

"We can say, and I hope we do, that older people in this society are to be valued as part of our families in the community. And the quality of life of older people is the most important thing for us, and therefore we have to pay more for health care. I believe we'll figure out a way to solve the problem of maintaining Social Security, dealing with



LAURIE HATCH SAYS THAT BROAD GENERALIZATIONS ABOUT THE ELDERLY SHOULD BE AVOIDED. "JUST AS IT IS TRUE FOR YOUNGER GROUPS, THE OLDER POPULATION IS A DIVERSE, NOT HOMOGENEOUS, GROUP."

diseases like Alzheimer's, and providing appropriate health care. But it will require a major change in our value systems as to what's important." ■



Relationship of informal caregivers to disabled elderly recipients of care. (Source: U.S. Senate, Special Committee on Aging, Aging America: Trends and Projections, U.S. Government Printing Office, Washington, D.C., 1988.)

The Convex Exemplar System, a state-of-the-art, parallel computer system housed in the basement of McVey Hall, is considered among the most powerful in an American academic setting.



Exploring Cyberspace

Technological innovation consists of three stages, linked together into a self-reinforcing cycle. First, there

is the creative, feasible idea. Second, its practical application. Third, its diffusion through society.

The process is completed, the loop closed, when the diffusion of technology embodying the new idea, in turn, helps generate creative ideas. Today there is evidence that the time between each of the steps in this cycle has been shortened. —Alvin Toffler, *Future Shock*

Now playing on a computer screen near you:

continued on page 14

Exploring Cyberspace

WRITTEN BY
SHEILA HUME
PHOTOS BY LEE THOMAS

video simulations of the expanding universe, particle by particle, brought to life by complex strings of endless mathematical computations.

A bit too heady? How about perusing the original 18th-century *Beowulf* manuscript, complete with erasure marks made by scribes during the Middle Ages, without leaving the comfort of your home PC?

It's now a reality, at least in the world of cyberspace, thanks to a variety of novel computer applications being developed by researchers throughout the university. Their work—ranging from simulating high-speed air flow in turbojet engines, to understanding how computers affect geopolitical relations between nations—will one day determine not only how fast we travel the globe, but how we relate to the local inhabitants once we get there.

The academic community has long been a front-runner in the brief but meteoric history of computers. Some of the earliest of computer applications—mostly data processing done on gargantuan machines that took up entire buildings—occurred on university campuses. And academic researchers were among the first to cruise on the ARPAnet, the forerunner of the high-wheeling information interstate we now refer to as the Internet.

With the advent of supercomputers, the academic stakes have been raised. In October of 1994, the University of Kentucky began installing the Convex Exemplar System, a state-of-the-art, parallel computer system considered among the most powerful in

an American academic setting. With its 32 processors and seven gigabytes of RAM, the "vex," as some researchers here have nicknamed it, is well suited for solving problems that require massive amounts of simultaneous, high-speed number crunching. "It's our

workhorse," says James McDonough, a computational fluid dynamicist in the Department of Mechanical Engineering. "The Convex system has been a factor in many researchers' decision to come to UK, and a motivation for those of us already here, to stay."

With all its prowess, one might imagine the Convex system to resemble the Starship Enterprise, or at least the cockpit of the Concord. In reality, however, the system is wholly unimpressive to look at, a lion in sheep's clothing. Housed in the basement of McVey Hall, it takes up less room than two six-drawer file cabinets. And rather than a dizzying array of blinking and beeping apparatus, a few LED lights indicate the system is on. "Systems are getting smaller and more powerful," comments Trent Fraebel, senior system programmer. "A decade ago the powerful Convex system—had it existed—would have filled all of McVey Hall, and then some," adds Fraebel. And because the computer world stands still for no one, the current Convex system has already been upgraded four times since it was installed just over a year ago.

A universe of possibilities

To begin to understand the depths of all of this processing power, one need only visit

computer workstations in departments such as physics, engineering, mathematics, or visit the College of Pharmacy. Researchers at these workstations are using complex numerical modeling to push the limits of computing technology.

At his computer workstation in the Department of Mechanical Engineering, James McDonough spends his days flying high-speed



RANDALL SPLINTER, A MEMBER OF THE COSMOLOGY GROUP IN THE DEPARTMENT OF PHYSICS AND ASTRONOMY, IS ATTEMPTING TO ANSWER, THROUGH COMPUTER SIMULATION, THE QUESTION, HOW WAS THE UNIVERSE CONSTRUCTED?

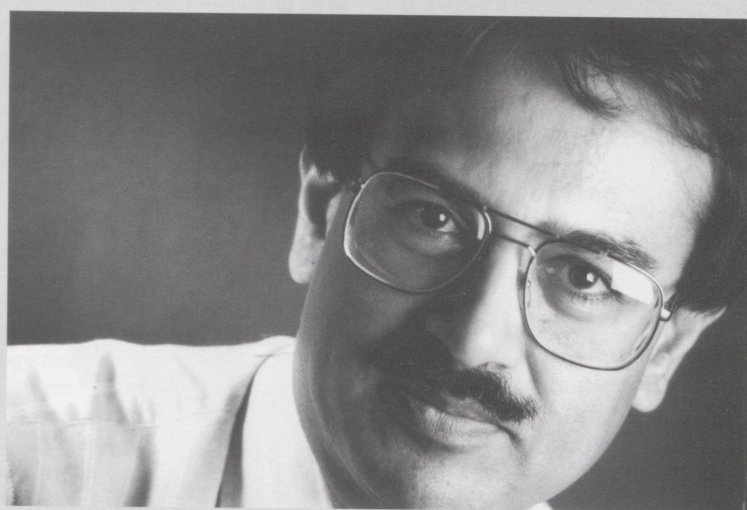
Exploring Cyberspace

jet planes without leaving the ground. Known for his earlier work on hypersonic re-entry vehicles, McDonough's latest project, supported by Pratt & Whitney and NASA, involves developing new methods for computer turbulence simulations in high-speed aircraft. This isn't the kind of turbulence that strikes fear in the hearts of nervous air travelers, but rather the type caused by high-speed air flow—close to the speed of sound—that cools the turbojet engines of those big planes.

"The turbine blades in these engines are operating at temperatures as much as 1,000 degrees Fahrenheit above what the materials can withstand," McDonough explains. "The engine would melt down without the active cooling." Calculating the necessary turbulent flow to cool those super hot blades is done on the computer. Using codes based on the laws of fluid motion (equations known since the mid-19th century), McDonough is able to direct the computer to do the computational analysis for him. Starting out with one differential equation, "You end up with thousands, and even millions of algebraic equations that the computer can solve efficiently. We simulate the results on the computer because there's no possible way a human could solve such problems analytically."

In this application, it's numbers in and numbers out—namely velocity, pressure, temperature, and density fields. The results are then carefully scrutinized with the aid of sophisticated computer graphics. Finally, the calculations are used to help design better cooling systems for turbine blades, eventually leading to better, longer-

lasting engine components that may make future air travel safer and cheaper. "We're quite certain," says McDonough, "that UK can make a significant contribution to the simulations of these high-speed flows, using the new turbulence models we're developing."



KUMBLE SUBBASWAMY, A MATERIALS PHYSICIST IN THE DEPARTMENT OF PHYSICS AND ASTRONOMY AT UK, IS USING THE CONVEX SYSTEM TO HELP UNLOCK THE MYSTERIES OF SOLIDS AND FLUIDS AT THE MOLECULAR LEVEL.

Pushing and probing the extremes of computing is by no means limited to high-speed aircraft. Think bigger. Think the entire universe. Within the Department of Physics and Astronomy, the Cosmology Group is using the computer to create large-scale models of the universe. Work being done by post-doctoral fellow Randall Splinter, along with Suketu Bhavsar, is attempting to answer, through computer simulation, questions that seem to border on the metaphysical: How was the universe constructed? How does matter cluster in an expanding universe?

What are the origins of superclusters and clusters of galaxies, and ultimately, galaxies themselves?

With funding from the Center for Computational Sciences, as well as the National Science Foundation, these archaeologists of the universe, along with dozens of other researchers throughout the world, are slowly beginning to understand the answers. Their hope is to learn about the early universe from the structure that exists today, as well as uncover clues about its future. To get there, researchers must process huge catalogues of galaxies, producing, in essence, a cartography of the universe. These "atlases" are then compared to large-scale simulations on the Convex system that try to model how matter clumps together in an expanding universe.

"The computer can actually evaluate the force exerted on every particle, by every

**No mind is much
employed upon the
present; recollection
and anticipation
fill up almost all our
moments.**

—Samuel Johnson

CONTINUED ON PAGE 16

Exploring Cyberspace

other particle," explains Bhavsar. "Then, using the laws of motion, the computer calculates the movement of each particle as a result of that force, and moves the particles to their next positions. It's really moving the universe forward in time, providing a picture at every stage of the process. If we combine the pictures, we get a movie."

In fact, that's exactly what Randall Splinter has done. Now playing on the group's home page on the World Wide Web is a video of the expanding universe (World Wide Web address is <http://www.pa.uky.edu/~splinter/cosmos.html>). What took nature 10 billion years to form, scientists are now illustrating on video for private viewing on the home computer. But those with anything less than about eight megabytes of memory shouldn't attempt to download the images. In the future, notes Bhavsar, the group plans to add hydrodynamics to the codes to simulate galaxy formation in even more realistic form.

Now think small. Very small. Think quark-size thoughts. Terrence Draper, along with other members of the Particle Theory Group, also within the Department of Physics, is studying quarks, the smallest known basic constituents of matter. Scientists know how these subatomic particles—the stuff that protons and neutrons are made of—behave, but relatively little is known quantitatively about how they bind together to form a proton. The difficulty lies in the fact that, unlike the electrons inside an atom, it is impossible for scientists to remove the quarks from the proton and study them separately, because they bind together so strongly, explains Draper. "With quarks, our old analytical tools fail us. The new techniques use computers to help us make those calculations."

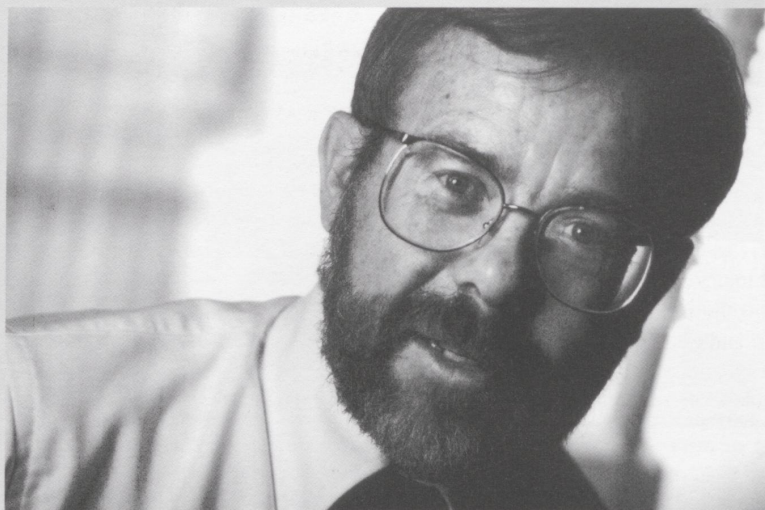
Using Lattice Quantum Chromodynamics, researchers create powerful mathematical algorithms which are then fed into supercomputers. After over a decade of computations, "We have learned a lot, but we still have a long way to go," says Draper. That translates into years before scientists crack the quark conundrum. "We'll need more powerful algorithms and computers that continue to advance in

power and speed. But answering these questions will raise new ones. We will never have all the answers."

The basic building blocks of life

When scientists push the limits of computer technology, they often run into cyberspace's version of the brick wall. But in doing so, they also push science forward, albeit in tiny increments, while simultaneously creating possibilities for each other.

In another laboratory in the Department of Physics and Astronomy, incidentally the biggest users of the Convex system at UK, Kumble Subbaswamy, a materials physicist, is using the computer to help unlock the mysteries of solids and fluids at the molecular level. While Draper probes the fundamental building blocks of life, Subbaswamy is consumed with the question of how those building blocks come together to form existing, as well as yet to be created, materials. And as is the case with Draper, what stands in his



PAUL EAKIN IN THE DEPARTMENT OF MATHEMATICS IS COMBINING BROADCAST TELEVISION WITH THE INTERNET TO TEACH GRADUATE-LEVEL CLASSES IN COMPUTER SCIENCE AND MATHEMATICS.

way is an endless sea of enormously complex computational problems, something on the order of 10 to the 23rd atom. "It's like constructing a building," says Subbaswamy. "If I know how the bricks are attached to each other, I'll know how to build the whole structure."

The latter is what the researcher refers to as the "holy grail" of materials theory: the ability to know how a mixture of compounds will react by simply plugging information into a computer. In the pharmaceutical industry, where the computer is now beginning to assist in the design of new and more efficient drugs, the future implications are staggering. Imagine being able to tell the computer what you want a new drug to accomplish, have the computer do the analysis, and then give back the exact compounds, in the exact proportions, to accomplish the job. "In the future, as computers get bigger and better, and the methods of computation get more sophisticated, we may get to that," says Subbaswamy. "For now, we're still building models, certainly nothing realistic."

Though the holy grail is still well beyond reach, Subbaswamy, along with his colleagues around the world, are pressing ahead. The UK researcher's current work, funded by the Department of Energy and the National Science Foundation, involves predicting what new compounds are possible by combining pure carbon and silicon clusters. His analysis, of course, is being done on the Convex system. What might it all lead to?

"One thing, not too far in the future, might be the creation of new and stronger polymers, something very close to the hardness of diamond, if not harder." And that, he adds, could be good news for space exploration. "We may see semi-conductors that function at very high temperatures, useful for a space module you want to send close to the sun."

Pushing the limits of computers

Waiting for computers to catch up with the present-day needs of scientists is hardly limited to physics. For instance, the computer technology doesn't exist yet for what Robert Buice, in the College of Pharmacy, or Zhaojun Bai, in the Department of Mathematics, are trying to accomplish.

Clad in blue jeans, a T-shirt and sneakers, Robert Buice's laid-back appearance completely defies the mind-boggling complexity of his computer research. In the cool darkness of a laboratory he shares with his researching partners in the College of Pharmacy, Buice is explaining how computers will eventually change the way a blood test is analyzed, or how pharmaceutical manufacturers will identify inferior capsules on a production line, increasing safety and quality control, while decreasing cost.

Recently Buice and his colleagues in the Applied Spectroscopy Group began examining ways to apply the supercomputing ability of the Convex system to the information-reading capability of sound and light waves. On the drawing board is a device that uses acoustic-resonance and near-infrared technologies to "unstack" the components of materials, from an X-ray picture to a particular pharmaceutical compound. One example is a blood sample in which cholesterol and lipoprotein levels are being measured. Once the chemical components of the sample are unstacked, this stratified data is then fed into the computer, which interprets it in terms of mathematical codes. In turn, those codes represent what the physician is looking for—the ranges these two measurements fall within. "Without the computer doing the computation, the unstacked information would just be miscellaneous junk," notes Buice.

Eventually, he explains, the device has the potential to radically simplify the analysis of blood, reducing the work to one desktop-size machine. Currently, multiple machines are used, slowing analysis and creating more room for error in interpretation. "An analytical

"The Convex system has been a factor in many researchers' decision to come to UK, and a motivation for those of us already here, to stay."

—James McDonough

method that minimizes sample handling and processing time will make measurements more accurate since the sample would have less time to deteriorate," he adds.

Part of Buice's doctoral work involves pushing the limits of the computer to determine just how much information it can read and interpret at one time. Once that prodigious task is completed, the next challenge will be to package the technology in such a way that a PC sitting in a doctor's or pharmacist's office can do the same analysis. The ideal, he says with a laugh, would be the "tricorder" in Star Trek. "No matter what the problem is, you would just wave the device over it and the computer inside would instantly analyze it." For now, however, the tricorder is a reality only on Star Trek reruns.

The future of computer technology

In a Lexington hotel in October, there occurred an unusual convergence of science and the humanities. A score of international scholars in literature, art history, archaeology, library science and computer science came together for a symposium titled "Reconnecting Science and Humanities in Digital Libraries." Sponsored by the University of Kentucky and the British Library, the conference united these unlikely bedfellows for the purpose of tackling a mutually important question: How can humanists and scientists come together to shape the future of computer technology? "Part of our objective was to communicate, face to face, the fact that computer technology is absolutely necessary for getting the world's rare and wonderful cultural documents out in front of people," says Kevin Kiernan, a professor in UK's Department of English and a symposium coordinator. "But that can only be done if you get humanists and computer scientists working together."

For Kiernan, the literary world and the world of megabytes and RAM began merging in the mid-'80s when he was experimenting with digital image processing to improve the legibility of the *Beowulf*

CONTINUED ON PAGE 18

Exploring Cyberspace

manuscript. In 1992, the British Library asked him to supervise the digitization of the original *Beowulf* manuscript, thereby creating the world's first electronic version of a medieval epic.

Using a digital camera that scans at 2,000 x 3,000 pixels in 24-bit color, Kiernan gathered a huge *Beowulf* archive made up of 21MB images files. In addition, the researcher used fiber-optic backlighting to recover some 2,000 letters along the edge of the manuscript, which had been damaged in a fire in 1731. Once painstakingly reconstructed, the lost letters were added to the digitized manuscript. The result is the Electronic *Beowulf*, a comprehensive, interactive electronic archive which consumes numerous gigabytes of disk space at both the University of London and the University of Kentucky. So innovative was the project that it won the 1994-95 British Library Association/Mecklermedia Award.

Yet spectacular images and text mean nothing if only a few individuals at supercomputer workstations can access them. Under the direction of Kiernan and Brent Seales, a computer scientist at UK, a team that calls itself GRENDL (Group for Research in Electronically Networked Digital Libraries) is creating software which "hypertextually" links all related images in the archive. This will allow users—everyone from scholars to school children—to explore the tale at virtually any level, from the simplest glimpses of text, to specific translations and complex overlays. Those more interested in pictures will be able, for example, to pull up displays of Anglo-Saxon helmets or shields. Graphic artists or students of ancient handwriting can enlarge the Old English letters for detailed examination. There are no rules in this electronic classroom; this is the hefty tome served up a la carte. Whatever the user's interest, accessing the program by computer affords views far superior than one can get in the original manuscript in the display case at the British

Library. A CD-ROM version of the Electronic *Beowulf* is due out next year.

Beyond exposing thousands of people around the globe to otherwise inaccessible works, projects like the Electronic *Beowulf* have far-reaching implications for teaching and research in general. For instance, James Force, a professor in the Department of Philosophy at UK, is now digitizing microfilms of Newton manuscripts to improve their read-

ability and, one expects, their accessibility. "The use of computer technology," predicts Kiernan, "will have an enormous impact on the ability of people to read and write and think about their culture in the century to come."

Computerized learning

When it comes to changing the way we learn, the computer is also making inroads in areas such as music, mathematics, and geography. Spend an hour or two in the Department of Music and watch students learn music theory or practice

vocal training on computer workstations that prompt responses and give instantaneous feedback. "No more red ink on a written test; this is instant feedback," says professor Chuck Lord, who with his colleagues in the Department of Music have spent the last decade developing an innovative, interactive music curriculum that allows the learner to control the learning experience, emphasizing exploration and experimentation over rote knowledge.

With the explosion in MIDI keyboards, and the use of interactive multimedia tools which allow learning to build upon itself from sources as diverse as sound, text, pictures and video, much of the music curricula of the future will be taught on the computer, predicts Lord.

Certainly, one of the fastest-growing forums for computerized learning is the Internet. With an estimated one million net-walkers



SUKETU BHAVSAR IS ONE OF A GROUP OF RESEARCHERS AT UK AND ELSEWHERE WHO ARE PRODUCING HUGE CATALOGUES OF GALAXIES THROUGH COMPUTER SIMULATION, IN ESSENCE A CARTOGRAPHY OF THE UNIVERSE.

Exploring Cyberspace



ZHAOJUN BIA OF UK'S DEPARTMENT OF MATHEMATICS, IN CONJUNCTION WITH RESEARCHERS AT TENNESSEE, BERKELEY, AND ARGONNE NATIONAL LABORATORY, HAS DEVELOPED NEW COMPUTATIONAL SOFTWARE (CALLED LAPACK) FOR SOLVING LARGE-SCALE MATRIX COMPUTATION PROBLEMS.

Is there such a thing as handing in an assignment late on the Internet when you're not exactly sure when it will arrive in the first place?

signing on each month, it is estimated that traffic on this "anarchistic electronic freeway," as *Time* magazine refers to it, will increase to 1.5 billion in the next five years. What will this all mean for the way we learn, as well as the value of what we learn?

In a new twist on distance learning, Paul Eakin in the Department of Mathematics is combining broadcast television with the Internet to teach graduate-level classes in computer science and mathematics. Students watch a real-time broadcast of a lecture on television—hardly a new format—but respond on the Internet. That means everything from homework to final exams is submitted electronically. According to Eakin, some interesting questions that don't fit the traditional rules of academia have inevitably cropped up. What does it mean to submit a test electronically? And what happens when a storm knocks out a student's electricity, or his or her hard drive takes a sudden nose dive? Is there such a thing as handing in an assignment late on the Internet when you're not exactly sure when it will arrive in the first place?

Despite the kinks, Eakin believes the Internet is here to stay as a learning tool, particularly in the area of post-graduate education where students don't need the direct supervision of a classroom. In the spring, he and his colleague in the mathematics department, Carl Eberhart, will teach a new Internet course, this time to Kentucky public high-school teachers at remote locations around the state. This advanced problem-solving class will focus on the development of material for KERA mathematics portfolios. When those same teachers go back to the classroom in September, their young students will become the direct beneficiaries of a summer of on-line learning.

The "greater society" of the Internet

If that seems like a rapid way of disseminating the latest that education has to offer, consider what's happening in the College of Pharmacy. Here, Robert Buice and colleagues have recently inaugurated an on-line research journal called *Wave of the Future*. By putting their research directly on the Internet, the Applied Spectroscopy Group is able to bypass the scholarly journals' three- to six-month editing and production lag time, and immediately get their

CONTINUED ON PAGE 20

Exploring Cyberspace

work in front of thousands of scientists around the world for instantaneous peer review. "If a million people want to review it, they can each give their comments. This is an incredibly rapid format for exchanging information," says Buice. Will the print journals ever be replaced by the high-speed internet versions? Probably not, say Buice and others, since print remains, at least for now, the best format for long-term preservation of a document.

Meanwhile, graduate students in the Department of Mathematics will soon be able to access a high-performance computing facility for solving complex engineering and math problems in the High-Performing Computing Laboratory under development in the College of Arts and Sciences. Using this facility, students can also perform shared, remote computations at national supercomputing centers such as Cornell University and San Diego Supercomputing Center.

New computational software (called LAPACK) for solving large-scale matrix computation problems has been developed by Zhaojun Bai of UK's Department of Mathematics in conjunction with researchers at Tennessee, Berkeley, and Argonne National Laboratory. LAPACK has been accessed by nearly one-half million Internet users since it was uploaded on the Internet in 1992. Bai is an expert in large-scale parallel computing in numerical analysis and its applications.

For all the fanfare, the Internet is not without its drawbacks. For one, with so many users jamming the highway, it tends to be slow, especially at peak times of the day. "The problem," says Subbaswamy, "is that the current speed of information transfer is much, much slower than the current speed at which an individual supercomputer can function. Even working in unison, the weak link is the network hard-

ware." Many scientists, including Subbaswamy, believe the problem will eventually take care of itself. As high-speed fiber-optic cable becomes pervasive, linking homes, offices, and local-area networks around the world, the need for increased physical bandwidth will be satisfied, they say.

But what about management of the rapidly expanding Internet? How much longer can it remain an informational free-for-all? And who exactly are the main drivers on this highway anyway? While we

don't know exactly who they are, Stanley Brunn, a professor in the Department of Geography, has been making some educated assumptions. As part of his "field work in cyberspace," as he puts it, he has been researching "virtual communities," Internet forums or bulletin boards that bring together people with shared interests in business, research and hobbies. In the process, he has come up with some interesting demographic statistics. Internet users are a largely homogenous group, the majority of them educated Americans. Not surprisingly, the main language of the Internet is English. Unconstrained by state or national boundaries, these electronic communities discuss science, politics, finance, religion, and other key topics of the day, in private conversations that the masses never see or hear. In one sense, says Brunn, these subscribers represent a "greater" society, those who live outside the state. "By and large, it's a pretty elite group," he adds, noting that much of the developing world is currently being bypassed on the information highway.

"It's an equity and accessibility issue. Those with the skills and knowledge will use the Internet; those without will be left behind." Brunn adds that deciding whether and when the information highway should be democratized, and by whom, are critical questions for the century ahead. ☐

"The use of computer technology will have an enormous impact on the ability of people to read and write and think about their culture in the century to come."

—Kevin Kiernan

HONORABLE MENTION

COMPILED AND EDITED
BY SUSAN HODGETTS TEMPEL

IMPACT AND ACHIEVEMENTS OF UK GRADUATE PROGRAM ALUMNI

MARGARET RIPLEY WOLFE,

Ph.D., History, '74, is the author of *Daughters of Canaan: A Saga of Southern Women* (published by the University Press of Kentucky), a book described as "the only chronological narrative of southern women's history that has ever been written." The book includes such disparate individuals as Pocahontas and the female astronaut Dr. Rhea Seddon. A native of Kingsport, Tennessee, Wolfe has had her book described by a leading authority on southern women's history, Catherine Clinton of the W.E.B. Du Bois Institute at Harvard University, as "a veritable romp through the southern past made enjoyable by Wolfe's abundant wit and prodigious research." While working on her Ph.D. at UK, Wolfe was awarded a Haggin Fellowship. She has been a professor of history at East Tennessee State University since 1969.

Photo by Kenneth P. Perry, CPP



MARGARET RIPLEY WOLFE'S BOOK, TITLED *DAUGHTERS OF CANAAN: A SAGA OF SOUTHERN WOMEN*, INCLUDES NARRATIVES ABOUT SUCH DISPARATE INDIVIDUALS AS POCAHONTAS AND THE ASTRONAUT RHEA SEDDON.

The mother of two sons, one of whom is attending UK, Lambert has also volunteered for the Jessamine County Operation Read program and the Jessamine County Hospice program. Originally from Bartown, Florida, Lambert resides in Nicholasville.

SALLY WARD MAGGARD,

Ph.D., Sociology, '89, was awarded a Pro Cultura Professorship in 1994 by the ProCultura Foundation of Hungary. As recipient of the award, she was a lecturer during the 1994 fall term at a Hungarian university. Originally from Hazard, Kentucky, Maggard resides in Morgantown, West Virginia, where she is an assistant professor of sociology and anthropology, and an adjunct professor of history at West Virginia University. As a doctoral student at UK, Maggard was the recipient of a dissertation fellowship from the American Association of University Women, a Lena Lake Forest Fellowship of the Business and Professional Women's Foundation, a James Still Fellowship in Appalachian Studies, and an Appalachian Studies Fellowship from Berea College.

F. FORD WALLER,

B.A., '49, M.A., Education, '67, has had a variety of professional experiences including serving as director of guidance and counseling at Sayre School in Lexington; scientific aid at the U.S. Atomic Energy Commission in Washington, D.C.; deputy director of accident control in the Ken-

DONALD FRICELLI,

M.A., Fine Arts, '75, is a native of New York City and still resides there. He is an adjunct professor of fine arts at Fordham University. As a student at UK, he served as a teaching assistant for Professor James Pierce in art history. He continued his studies at Ohio State University, receiving a Ph.D. in art history in 1975. Fricelli says that his career has been centered on teaching at Ignatius College, a college within the campus of Fordham. He was selected to originate several new courses in art and architectural history, and is currently pre-

senting a team-taught course, "The Mind of the West," to "reacquaint students with the Western intellectual and artistic tradition."

KATHY LAMBERT,

B.A., '88, M.S.W., Social Work, '89, is a certified social worker for the Comprehensive Care Center in Nicholasville, Kentucky, in the center's therapeutic rehabilitation program. Previously, she was an outpatient therapist in Casey County and worked in therapeutic rehabilitation in Harrodsburg.

CONTINUED ON PAGE 22

tucky Department of Safety; vice president of public relations at Claridge Hotel in Atlantic City, New Jersey; and vice president of sales for the Lafayette, Phoenix and Campbell House hotels in Lexington. Waller is now president and owner of Agincourt Farms, Inc. in Georgetown, Kentucky, and lives in Lexington.

PAT YOUNG NICKELL,

B.A., '67, M.S., Education, Ed.D., Curriculum & Administration, '76, is director of instructional improvement for Fayette County Public Schools in Lexington. She currently serves as vice president of the National Council for Social Studies and will assume the presidency in 1996. Nickell's husband, William (Nick), also graduated from UK in 1967 and their son Alan graduated from UK in telecommunications in 1994. Another son, Joe, is an Indiana University graduate. Nickell says that three fourths of her family agree that "there is no finer education to be had than at UK."

CARL JOSEPH POST,

M.A., '72, Ph.D., History, '76, is the associate director for the Graduate Emergency Medical Service Program at the New York Medical College Institute for Trauma and Emergency Care in Valhalla, New York. Post had a dissertation fellowship at UK from 1975 to 1976. During his career, he has published 90 articles and a book. At NYMC, Post has been instrumental in building the EMS program in five years from a group of four students to 40 students. Now residing in Lawrenceville, New Jersey, he is married to Bonnie Hawks Post, who received an M.S.W. from UK in 1973. He reports that in his free time he coaches hockey and teaches chess at the Princeton Y.W.C.A. to second through fifth graders.

BARBARA SCHELSTRATE

(formerly Barbara Reinhardt), *M.A., Fine Arts, '73*, is a free-lance pianist, composer, and does voice-overs. She indicates that being on the air for National Public Radio

DARNELL JOHNSON,

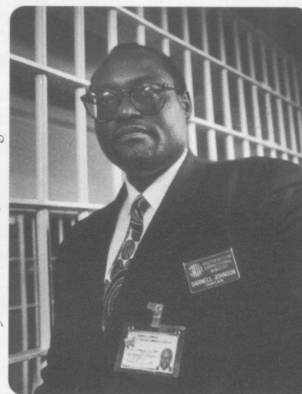
M.A., Math Education, '77, has been serving for the past 16 years as a chaplain for the Portsmouth City Jail in Virginia. He describes the prisoners he counsels as "great people" [who made] "poor choices." Recently selected for the Liberty Bell Award by the Portsmouth Bar Association, Johnson teaches Bible classes at the jail two days a week and is available for counseling on most other days. Counseling, he says, usually involves inmates who face family emergencies or threaten suicide. Professionally, he is also busy as a teacher, coach, assistant principal and as principal of an alternative program for students in grades six through 10 who have had some adjustment problems. Johnson is married to Stephanie D.B. Johnson; they have a daughter who is expecting twins at about the time this issue of *Odyssey* is published.

LUI FREDERICK JONES,

M.A. Education, '31, says that his most important career achievement was being the first chemistry teacher to Dr. William Lipscomb, who eventually became a Nobel Laureate. Jones was teaching at Picadome High School in Lexington in 1936 and 1937 when Lipscomb was a student there. Jones's hometown is Brookfield, Missouri, where he got his undergraduate degree from Brooklyn Wesleyan College. He now lives in Louisville, Kentucky.



Photo by Mark Mitchell, The Virginian-Pilot



HONORABLE
MENTION

from 1977 through 1983 was a career highlight for her. Some of her other accomplishments include writing the music for a children's play, *The Snow Queen*, in 1994; writing and producing the theme music (string quartet and piano) for an audio tape series for the General Agents and Managers Association in 1995; and serving as pianist for a professional production of a Stephen Sondheim revue in 1994. Schelstrate says, "I enjoy music every bit as much as I ever did, but in ways I never imagined possible." Originally from Indiana, she now lives in Arlington, Virginia.

MELVIN W. DENNER,

M.S., Zoology, '63, is acting dean at the School of Science and Engineering Technology at the University of Southern Indiana in Evansville. As a graduate student at UK, he was awarded fellowships from both the National Science Foundation and the National Institutes of Health. After graduating from UK, he returned to his home state of Iowa and earned a Ph.D. from Iowa State University. He has been named outstanding teacher of the year six times and was honored as Indiana Professor of the Year in 1988. Besides authoring more than 20 scientific articles and serving as the national treasurer of the American Microscopical Society, he has received numerous professional recognitions and awards. Denner is married to Anne Greer, who also graduated from UK. She is an instructor and R.N. at the University of Southern Indiana. The couple are the parents of twin sons, Mike and Mark, born in 1971.

ANN M. WELLS,

B.A., Spanish and French, '78, M.A., Patterson School of Diplomacy, '83, is currently on leave from the Department of State to pursue a doctoral degree in environmental and developmental economics at the University of Maryland. Wells was



LAWRENCE GAITSKILL IN LATE 1943, SHORTLY BEFORE HE SHIPPED OUT TO FRANCE TO SERVE IN WORLD WAR II.

LAWRENCE R. GAITSKILL,

A.B., '48, M.A., Political Science, '58, continues his studies at UK, now as a Donovan Scholar studying French and Italian. He says that he had been a student at UK in the '40s, '50s, and '60s, and that he is also a member of the UK Alumni Association. Now Gaitskill is a professor emeritus of political science at Schoolcraft College in Livonia, Michigan, and resides in Lexington, his hometown. As a graduate student he studied with Professors Ernest G. Trimble and Alex T. Edelman, but the responsibilities of three children meant that he had to begin work after receiving his M.A. He was awarded a Fulbright Scholarship to France for 1952-53 and had a graduate assistantship in political science in 1948-49. Between 1943 and 1945, Gaitskill served in the army in North Africa, Italy, France, and Germany, was part of Invasion Arrowhead, and was subsequently awarded five Bronze Stars and a Bronze Service Arrowhead.

commissioned as a foreign service officer in 1984, her first assignment being to learn Chinese (which she describes as "six excruciating months"), before she went to her initial posting in 1985 in Guangzhou (Canton) China. Next she was appointed economic officer in the American embassy in San Jose, Costa Rica. From there she went on to the American embassy in Bogota for three years, where she covered financial, mining and petroleum and investment sec-

tors, did macroeconomic reporting and helped to negotiate a tax exchange agreement. After returning from Bogota in 1993, she served as the Colombia desk officer at the Department of State in Washington, remaining heavily involved in much of the work she had started in Colombia. Wells grew up on a farm in the Lexington area where her family still resides.

CONTINUED ON PAGE 24

JOHN P. McDONALD,

Ph.D., Business & Economics, '81, has been named senior vice president for marketing for Health Systems International, Inc (HSI). A veteran of more than 11 years in corporate marketing and opinion research concentrated in the health-care industry, McDonald will direct HSI's marketing efforts in eight states. HSI is one of the largest health maintenance organizations in the U.S., serving more than 1.6 million members.

JAMES J. HOECKER,

M.A., '76, Ph.D., History, '78, was reappointed by President Bill Clinton to the Federal Energy Regulatory Commission. A resident of Virginia, Hoecker has served on the commission since 1993. As a member of the commission, he will participate in approving rates and terms for the transmission and sale of electric power in interstate commerce and for the transportation and sale for resale of natural gas in interstate commerce. In addition to his degrees from UK, Hoecker has a law degree from the University of Wisconsin.

SANDRA R. DARNELL,

M.A., Education, '88, is director at the Audubon Center for Economic Education in Owensboro, Kentucky. She teaches fourth grade full-time and serves as director of the Economic Education Center part-time. She also teaches two elementary methods classes at Brescia College in Owensboro. Among the honors and recognitions she has received is the Presidential Award for Excellence in Science Teaching in 1992, 1993 and 1994 and a National Science Foundation summer grant in 1993 which financed her study of astronomy, physics and science at the University of California at Berkeley.



WAYNE D. MULBERRY,

M.B.A., '93, is chief operations officer and general manager of Multi-Link Inc. in Nicholasville, Kentucky. He cites his most important career achievement to date as his responsibility for starting a new company, ARDIS, which is a joint venture including IBM and Motorola. A Kentucky native, Mulberry resides in Georgetown, Kentucky, with his wife Greta Press and four children—Whitney, Shawn, Morgan and Ashley. Mulberry reports they have one grandchild, Juston Wilson. A U.S. Navy veteran, Mulberry is a YMCA youth counselor, as well as a Boy Scout leader.

WAYNE D. MULBERRY SAYS HIS MOST IMPORTANT CAREER ACHIEVEMENT IS STARTING A NEW COMPANY, ARDIS, WHICH IS A JOINT VENTURE INCLUDING IBM AND MOTOROLA.

ALLEN K. HESS,

M.A. '69, Ph.D., Psychology, '73, is distinguished research professor and department head at Auburn University at Montgomery, Alabama. A New Yorker by birth, Hess lives in Montgomery with his wife, also a UK graduate, who Hess says is "my research partner as well as life partner," and their daughter Tanya, 20, who recently graduated with high honors from college and is entering Emory University for doctoral studies. The couple also have a daughter, Clara, who is 14, and a son, Joel, who is 11. During Hess's studies at UK, he worked with Professors Ronald Doctor and Robert Dies in psychology, evaluating whether psychopaths were differentially able to learn under different reward conditions.

DENNIS BRICKING,

B.A., Political Science, '65, Law, '68, is executive director of the Legal Aid Society in Louisville and has been with the organization for 24 years. His priorities since becoming director of the society in 1975 have included adding outreach programs to help women and children who are victims of abuse find safe havens, fighting discrimination against people infected with the HIV virus, and protecting the rights of the homeless. Bricking and his wife of 31 years have three daughters—Jennifer, Elizabeth and Erica.

ALUMNI OF ANY OF UK'S GRADUATE PROGRAMS ARE INVITED TO COMPLETE THE INFORMATION FORM ON PAGES 25-26. WE WILL SHARE AS MANY OF YOUR RESPONSES AS POSSIBLE IN FUTURE ISSUES OF ODYSSEY.

INFORMATION FOR ODYSSEY MAGAZINE

OUTSTANDING ACCOMPLISHMENTS OF OUR GRADUATE SCHOOL ALUMNI

PLEASE TYPE OR PRINT

Your Name: _____
If your name was different at the time of your graduation,
please indicate that name as well: _____

Address: _____

Phone: (Office) _____ (Home) _____ (Fax) _____

Hometown: _____

Undergraduate degree and year conferred: _____

Name of institution granting your undergraduate degree: _____

Year your UK graduate degree awarded: _____

Degree: _____ UK College: _____

UK Department: _____

Additional Graduate Degrees

Degree: _____ Institution: _____

Year Awarded: _____

Degree: _____ Institution: _____

Year Awarded: _____

Professional Experience

Current Position: _____

Name of Company/Institution: _____

Location: _____

Career Highlights: _____

UK Background

Were you a fellowship recipient? ☐ Yes ☐ No A scholarship recipient? ☐ Yes ☐ No

If yes, to either, please indicate the name of the fellowship or scholarship: _____

Were you involved in working on any faculty research projects during your graduate years at UK? ☐ Yes ☐ No

If yes, please complete the following:

Name of faculty member(s) with whom you worked: _____

Department(s): _____

Brief description of project: _____

Agency, if any, that funded the research: _____

(INCLUDE ADDITIONAL PAGES IF NEEDED)

-OVER-

What do you consider your most significant achievement to date?
(include additional pages if needed)

Family information that you would like to include:

Any other information you would like us to have:

Current Date: Your Signature:

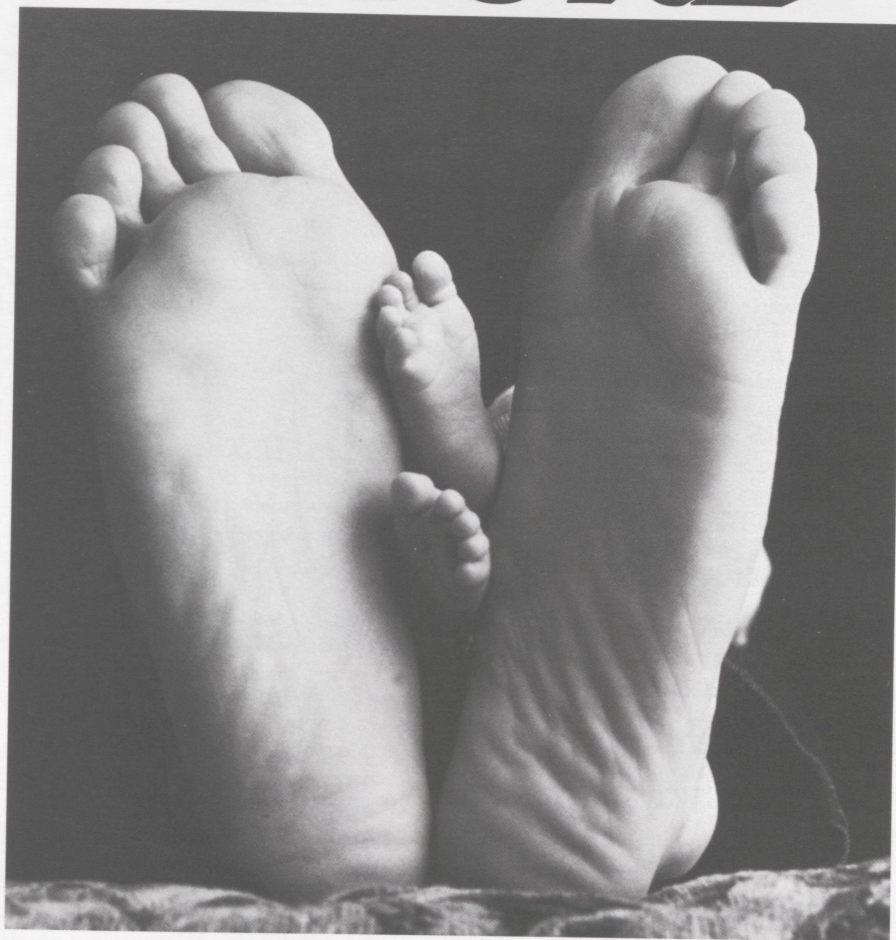
Are you presently receiving *Odyssey* Magazine? ☐ Yes ☐ No

If not, would you like to be added to our mailing list? If so, please indicate your mailing address below:

Thanks for letting us know about you. Please mail or fax this form to:

Odyssey Magazine
Kinkead Hall
University of Kentucky
Lexington, KY 40506-0057
or
FAX to (606) 257-8298

STEP *by* STEP *into the* **FUTURE:**

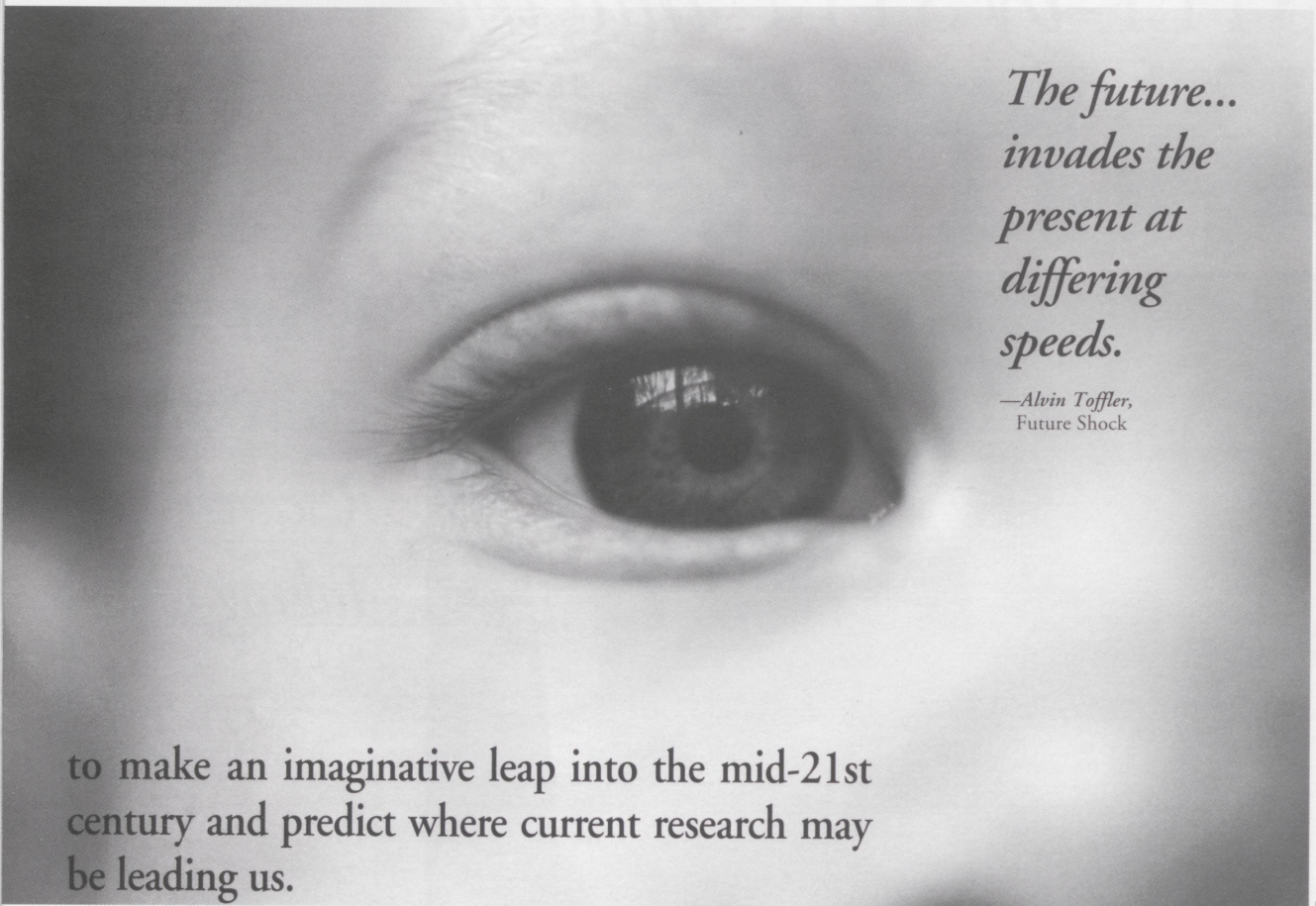


*Where is
University
Research
Taking Us?*

A cancer-free society? Genetically created super-athletes? Computer-operated farm machinery? A re-definition of family? Disney in the Bluegrass?

These are just a few of the questions that arose when a cross-section of UK researchers was asked

*continued on
page 28*



*The future...
invades the
present at
differing
speeds.*

—Alvin Toffler,
Future Shock

© Ron Chapple 1993/PPG International Corp.

to make an imaginative leap into the mid-21st century and predict where current research may be leading us.

There seems to be a consensus that technology is, and will continue to be, up to the challenges of the future. But the human factor, as always, is the wild card in the futuristic deck. How will we live, at what cost, and, most importantly, will our lives be worth living?

The continuing challenge of cancer

"A cancer-free future? I'd love to think so, but I don't think it's going to happen by the middle of the next century."

This disconcerting assessment by Kenneth Foon, director of UK's Markey Cancer Center, is balanced abruptly, however, with a discussion of some new "very promising therapies" for cancer patients. "The basic research that has been going on for so many years is now clearly starting to pay off," Foon says. "And I expect medical diagnosis and treatment of cancer to advance dramatically in the next 50 years as a result of this continuing research."

One example of a recent breakthrough, he explains, is a drug that was developed through research at the Scripps Foundation in California, where Foon formerly worked. Chemists there synthesized a drug that turned out to be the "magic bullet" for a rare type of leukemia. "A rare but sometimes devastating form of leukemia, called hairy-cell leukemia because its cells look hairy under a microscope, killed people five years ago," Foon explains. "There was no cure. But now the disease is virtually 100 percent controlled by a seven-day treatment using this drug. If we can find the magic bullet for one type of cancer, I'm hopeful that as research continues we'll find drugs that can cure other cancers as well."

As we move into the 21st century, Foon believes that the easiest cancers to treat will

WRITTEN BY
JEFF WORLEY
PHOTOS BY LEE THOMAS

continue to be blood cancers—leukemias and lymphomas (cancer of the lymph glands)—and testicular cancer, which is “remarkably curable now,” he says, “with chemotherapy.” He also sees some forms of treatment that up until recently have been thought to be radical or almost futuristic becoming more “mainstream.”

“I have many patients now,” says Foon, who also heads the hematology/oncology division in the Department of Internal Medicine at UK, “who have been treated with bone-marrow transplants—many more than, say, 10 years ago.” Foon says that the prognosis for bone-marrow patients is significantly better now than in the past, and that such procedures will continue to be more common.

The areas that may hold the greatest promise for cancer treatment, Foon says, are genetic diagnosis and the molecular biology of cancer. “Some very exciting recent findings have enabled us to identify genes that can predict colon, breast and ovarian cancer for people who have strong family histories of these cancers.” A diagnostic test to discover such genetic markers isn’t available yet on a wide scale, but Foon thinks that it will be soon. “In the near—not even the distant—future, such diagnostic tests will be commonplace,” he says.

Discovering a breast-cancer gene in a woman’s genetic blueprint would, for example, alert her to be particularly watchful for signs of breast cancer. A woman with a strong family history of breast cancer—a mother and a sister who had developed tumors, and a personal history of recurrent cysts and other benign tumors, for instance—might elect to have a mastectomy, a presurgical strike of sorts.

But throughout his discussion of what science may or may not be able to accomplish in the treatment of cancer, Foon returns to the extreme importance of basic research.

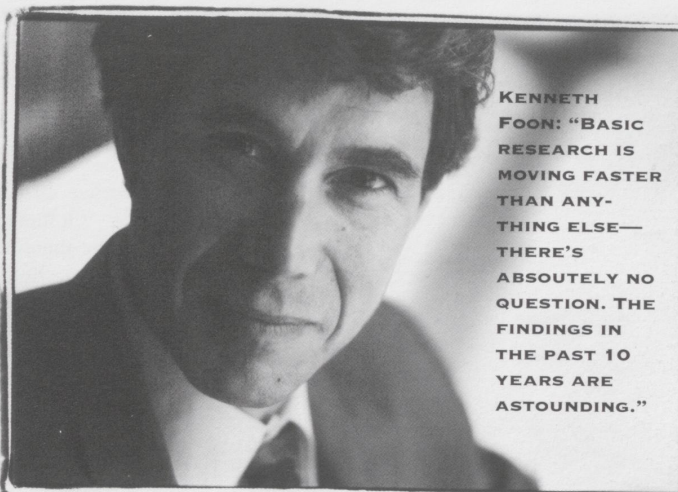
“Basic research is moving faster than anything else—there’s no question,” he says. “The findings in the past 10 years have been astounding. And in 50 years? God only knows how much we’re going to learn about tumor biology.”

Foon is dismayed, as are cancer researchers elsewhere, that the national budget doesn’t earmark more funding to support cancer research. “Certainly, considerable funds are committed for research, but at the National Cancer Institute only 12 to 14 percent of the approved grants are funded. That’s a depressingly low percentage.” He adds that this percentage is a significant drop from 15 to 20 years ago, when around 30 percent of such grants were funded. “It’s a sad matter of priorities,” Foon says. “Clearly many outstanding projects aren’t being undertaken because of lack of funding.”

And although basic research is moving ahead in its quest to unlock the secrets of cancer, Foon says that a major challenge will be to translate those findings into cancer cures. “This,” he says, “is going to be our greatest challenge over the next 50 years.”

Designer genes: trying for the right fit

Fred de Beer, a professor in the Divisions of Molecular Medicine and Rheumatology at the UK Medical Center, agrees with Foon about the promise that gene diagnosis therapy holds for the future. “The whole idea of diagnosing disease at the gene level is exploding,” de Beer says. “There’s no doubt in anybody’s mind in molecular medicine that this will be an extremely effective and precise way to diagnose and treat disease. It is happening all around us even with diseases such as hypertension, and I



KENNETH FOON: “BASIC RESEARCH IS MOVING FASTER THAN ANYTHING ELSE—THERE’S ABSOLUTELY NO QUESTION. THE FINDINGS IN THE PAST 10 YEARS ARE ASTOUNDING.”

believe it will soon happen with other complex diseases such as diabetes.”

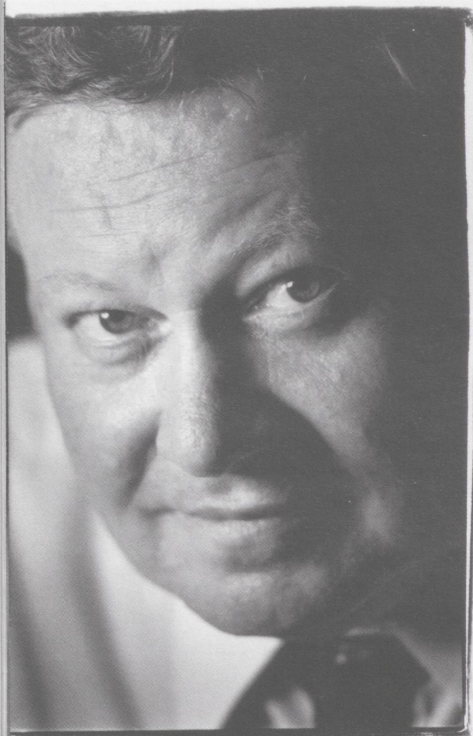
Gene therapy, de Beer says, is not only a strategy for the distant future; it’s an approach already being tried today. Research has already shown that defective genes which cause some diseases can be repaired, he says, adding that this genetic manipulation is “just the tip of an iceberg.”

The repair process, de Beer explains, involves isolating a healthy gene from living tissue and attaching this gene to a virus whose infective genes have been removed. A patient would take this “viral carrier,” and it would piggyback the healthy gene to cells where it would release, or “express,” as de Beer terms it, its cargo.

This approach has already been shown to work in many areas of medicine, de Beer says. For instance, at the University of Texas researchers used a viral carrier to correct abnormalities in the way a certain type of mice handle cholesterol. The key defect in these animals is that they did not have a receptor for the high-cholesterol-carrying particle. By using a virus, the gene for the receptor was inserted into these mice and they now handle cholesterol normally.

“It is not too far-fetched,” says de Beer, “to think that this could be done in humans. We’ve constructed a number of viruses here at UK that generally do the same thing—they contain genes which al-

CONTINUED ON PAGE 10



FRED DE BEER SAYS THAT THE TECHNOLOGY FOR GENETIC DIAGNOSIS IS "ALREADY VISIBLE TO US. WE CAN SEE WHERE IT'S GOING TO GO. WE CAN SEE THAT IT'S GOING THERE FAST."

ter the way cholesterol is metabolized with the aim of repairing such defects." If this process sounds like it's just been taken from the highest realm of the high-tech, de Beer assures us that it has. "It's a very sophisticated, high-tech approach that needs many skilled people to engineer it. But it's doable and is being done."

The possibilities, if not endless, he says, are many. "Take, for example, the case of a child with hemophilia, someone with a severe blood-clotting deficiency. Wouldn't it be fantastic if you could repair the gene or put in the new gene to give the child normal blood-clotting function?" When asked how close such a process is to happening, de Beer says, "Closer than we think."

The power of using these techniques to diagnose those at risk for various diseases is enormous, he says. Women with risky

family histories of breast cancer will routinely be genetically diagnosed long before the cancer even starts, de Beer says, echoing Foon. Real prevention will become possible.

De Beer rolls out the words "hypertrophic obstructive cardiomyopathy" as one example. "Or more simply, H.O.C.M.," he says, "the abnormality in the heart which causes young, fit athletes to drop dead." He says that researchers now understand much of the genetics that underlie the errors in the gene in muscle that is responsible for this condition, and by identifying this gene researchers can diagnose the disorder. "You can actually predict which of these individuals will develop it," he says, adding emphatically that "diagnostic medicine in this country will need to be re-tooled in the future to accommodate the power of these new diagnostic techniques."

Though the technology for this work is at hand, de Beer worries about the long-range moral and ethical implications of gene therapy. "In this process we will also gain the ability to do such things as make the muscles stronger. We will be able to make super-athletes. Do we want to do that?" He adds that we will have the ability to hand tool our offspring before birth if we want to, at least to some degree. "How," he asks, "are we going to control that?"

"I'm not at all sure that our society is morally mature enough to handle decisions like these," de Beer says. "We humans seem to be very capable—eager even—to rush to excess when these new technical opportunities present themselves. How are we going to regulate the power of the new genetic manipulations? I personally wouldn't feel comfortable at all leaving decisions like these to politicians or even the present judicial system. But," he says with a slight shrug of exasperation, "it will be very interesting to see how it all unfolds."

The formidable challenge of AIDS

When someone compares, for example, the flu virus to the HIV virus, Richard Greenberg, head of the Kentucky AIDS consortium located at UK, is quick to point out that in its trickiness and its ultimate

We will have the ability to alter our children before birth to our specifications. That's conceivable at least to a degree. How are we going to control that?

—Fred de Beer

power, HIV is to the flu virus what a hydrogen bomb is to a firecracker. "Where flu antigens may change a couple of times a year," he explains, "an HIV virus might mutate a billion times in one day."

"Or take something like hepatitis B," says Karen Bowen, RN and executive director of the consortium. "The virus that causes hepatitis B is a lock, and there's a vaccine that's a key. You stick the key in the lock and turn it off so it doesn't cause problems in your system." Developing an effective HIV vaccine is an altogether different challenge, she says: HIV keeps changing the locks.

In what might be the biggest challenge to medical science in history, Greenberg says there have been, so far, four steps.

"The first step was understanding the disease and getting a handle on its epidemiology and its transmission," Greenberg says, "and this is still evolving." The disease, which in this country broke out in gay communities but is now rapidly becoming more of a heterosexual disease, can be stopped with behavioral modification, Greenberg says—through barrier protection or abstinence, or through a better knowledge of your partner's sexual history. "This behavioral modification," Greenberg says, "is going to take a generation or two to occur."

The second step, he explains, is to understand what drugs are currently available and what they do and don't do. "There are currently four drugs on the market for people who are clinically ill with symptoms related to the virus," Greenberg says. "These

drugs add from one to three years of life to someone who is infected."

The third step, Greenberg says, involves trying to understand a new set of drugs called protease inhibitors, combinations of drugs that interfere with the replication of HIV and therefore increase patient survival. Proteases, Greenberg explains, are enzymes that chop away at cell proteins and make it possible for the HIV virus to form. Because protease inhibitors make it difficult for the virus to form, the "viral burden," as Greenberg calls it, is drastically reduced.

"You do not get rid of the disease, but you reduce the viral burden by as much as 99.9 percent," he says. "Consequently, the number of lymphocytes, the primary targets for HIV as well as the regulators of your body's defense system, rises dramatically and during that time the body has a much better chance to fight off any viruses and bacteria that might attack." A significant variable, Greenberg adds, is that HIV mutates in some people much faster than in others, and "there's no way to predict this."

One of the studies Greenberg and Bowen are involved in now is a national protocol that is measuring the effectiveness of protease inhibitors. The patients in the study, which began in May of this year, already have AIDS and historically, Greenberg says, have one and a half to five years to live. Some of the volunteers are given protease inhibitors and some are given a placebo.

"It's a blinded study," says Greenberg. "The patients don't know whether they're being given drugs or not. But I want to emphasize that when someone develops further immune problems, he will be switched over to the new drug." Bowen says that right now there are 1,400 people taking part in this study nationwide. Thirty of these are Kentucky residents, who are taking part through the AIDS Consortium. Bowen adds that she would be pleased to add more people to the Kentucky consortium's studies.

Will this new class of drugs be able to fight off HIV? How hopeful are Greenberg and Bowen that this may be a long sought-after breakthrough?

"There's been a sad history of anti-HIV drugs coming through the FDA, then avail-

RICHARD GREENBERG SAYS THAT THE ONLY WAY TO KEEP UP ON DEVELOPMENT IN AIDS RESEARCH IS TO ATTEND MEETINGS. "THIS IS WHERE PRELIMINARY RESULTS ARE DISCUSSED. BY THE TIME THE INFORMATION IS PUBLISHED IN A JOURNAL, IT'S ALREADY OUT OF DATE."

able on the market and given to infected patients, who *do* improve for a time," Bowen says. "But because the virus can mutate so swiftly, the effect of the drugs—for reasons that aren't clear yet—over a period of time wanes and the viral burden rises again," adds Greenberg.

Step four in trying to understand and control this disease, he says, is to develop a vaccine, or several, which will prevent HIV. "It's simplistic and naive to believe that it will be as easy as curing polio or smallpox, for example," Greenberg says. "HIV is on a whole other order of difficulty."

How long will it take to develop a vaccine that prevents HIV infection? "I don't think it will anytime soon, unfortunately," Greenberg says. "But with the way research is helping us understand the virus now, I think that by the middle of the next century, people will be able to be immunized against the HIV virus."

Bowen believes that AIDS is a problem that isn't going to vanish any time soon. "The generation that was young when AIDS broke seems to have the attitude that 'it isn't going to happen to me.' For the most part, they just aren't heeding the warnings. Behavior modification hasn't succeeded. Education hasn't succeeded."

"There are countries in Africa now where one in 40 individuals—male and female—have an HIV infection," Greenberg adds. "And I don't like to play a sour note, but unless in this country right now there's significant behavioral modification, the cur-



rent young generation is in for a big shock."

Organ transplants

While AIDS researchers are doing everything in their power to try to boost the immune system, John Thompson in his work has a different focus. He wants to put it to sleep.

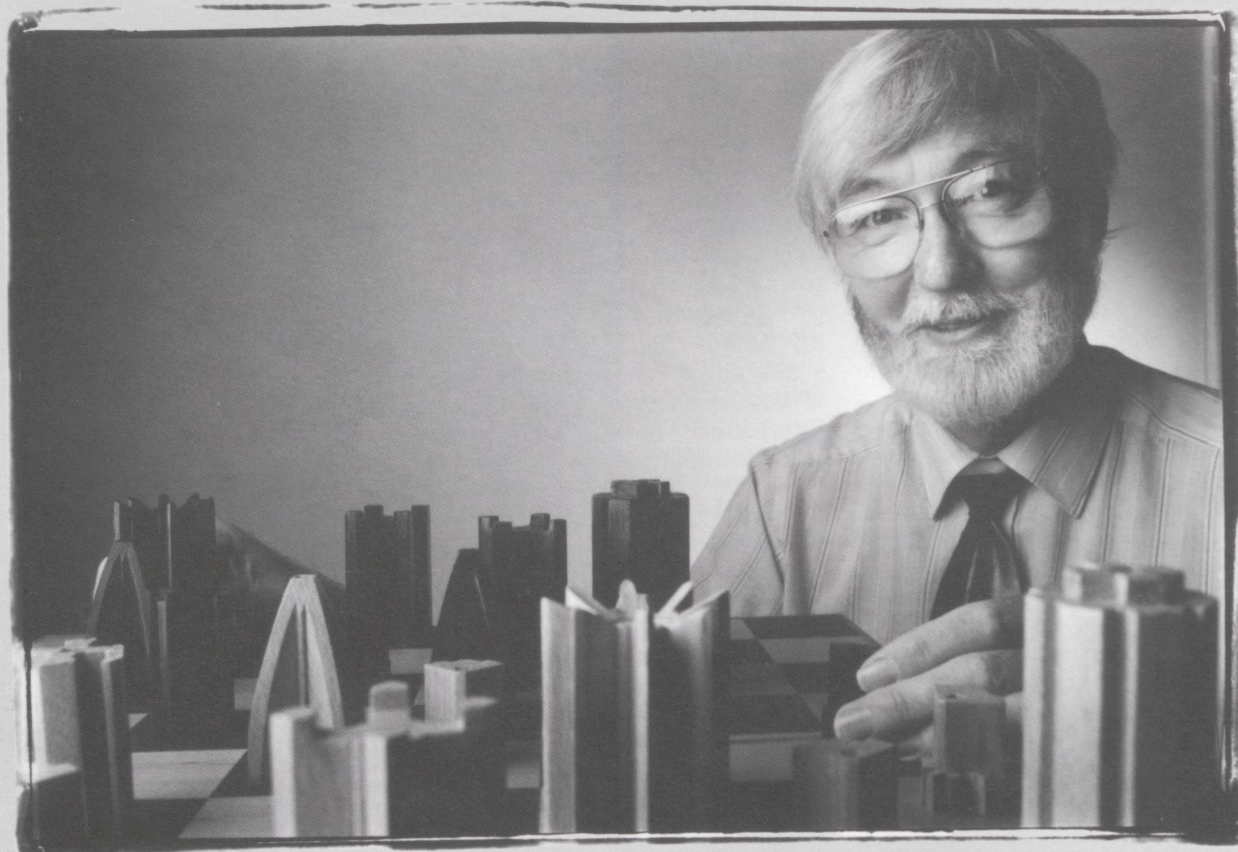
Thompson, a professor in the Division of Allergy and Immunology in the Department of Internal Medicine, has been working for 20 years to develop drugs that inactivate the immune system for a time so that a patient doesn't reject an organ transplant.

"If it's doing its job, the immune system marshals its forces to oust any foreign invaders which, of course, is a good thing," Thompson says. "In the case of trying to get a transplant, or graft, to take, though, we need to put these defenders in a temporary state of unconsciousness."

He says that because several new drugs developed in the past three decades have effectively deactivated the immune system, organ transplantation has had greater success rates. One of these drugs is cyclosporine. "This drug has been the main reason why liver transplantation works," Thompson

CONTINUED ON PAGE 34

STAN BRUNN BELIEVES THAT BY THE MIDDLE OF THE NEXT CENTURY DOWNTOWN LEXINGTON WILL BECOME A "HEDONOPOLIS," AN ACTIVE CENTER WHERE PEOPLE WILL COME FOR ENTERTAINMENT, CULTURE AND LEISURE ACTIVITIES.



The Lexington of the future

It's a Saturday. You slide into your sub-sub compact in the newest subdivision 10 miles from the center of Lexington. You drive to the shopping mall a mile away to buy a few things and to meet with your gardening club in the Mall Club Complex at 10:00 and your cello group at 11:00. Then you head out I-64 toward Louisville. Just past Shelbyville, you pull into the Kentucky Entertainment Complex—Disney World, wild animal park and Triple A baseball stadium—just in time to make the first inning of the Thoroughbreds game. Later, you will drive to downtown Lexington to one of the many outdoor cafes, where you and a friend will decide which of the evening's 30 musical and cultural events you feel like attending tonight.

This composite scenario is from University of Kentucky's Stan Brunn, who believes that Lexington will become, as the decades roll by, more and more of an "amenity city."

"Situating between the Frostbelt and the Sunbelt, Central Kentucky is a unique landscape in North America," says Brunn, a professor of geography. "And Lexington is clearly an amenity city—a place where people come to visit horse farms, drive through the countryside surrounding Lexington, or for various cultural activities. I believe in the years to come

we'll see even a stronger emphasis on tourism, on developing recreational possibilities and related types of activities to entice people to come here."

Various types of horse parks, a minor league baseball team, and Disney in the Bluegrass may be among the new amenities we'll see by the middle of the next century, Brunn says. "Sure, why not? Here in the Triangle [Cincinnati, Lexington, Louisville] near two of the main arteries—a huge theme park. And right next to that a pro baseball team and, perhaps, some sort of tame or wild animal kingdom. People would flood into this area."

In order, though, for Lexington to play to its strength as an amenity area, we will have to resolve what Brunn calls "the major obstacle" to this area being a good place to live in the future. "To what extent are we going to retain the image of Lexington if we have expansion by developers in the area?" he asks. "Expansion into horse farms and construction of more shopping centers? There's no question that the conflict will continue between those who want to retain the traditional image of Lexington and the Bluegrass landscape, and those who want to make it into something different."

Solidly on the side of maintaining the historical image of the Bluegrass is Brunn's colleague Karl Raitz, who has taken a special interest in the rock fences of this area. "In the past half century, primarily through the widening of roads as the inevitable result of development, hundreds of miles of rock fences have been toppled and destroyed," says Raitz. He adds that the future of rock fences "looked bleak—until now."

"My research assistant, Carolyn Murray-

Wooley, got a grant to bring in a Scottish stone mason to Lexington to teach local masons how to correctly build dry-laid rock fences in the traditional way," Raitz says. "This will produce fences that should last a century or more." Training a new generation of masons with these skills is important, Raitz says, especially with what seems to be the inevitability of roads being widened in this area in the future. When the reconstruction of Paris Pike begins, and the road is widened, masons will be hired by contractors to move the existing fences and rebuild them. "The fences will continue, then, to be functional and to serve as tourist attractions," Raitz says.

And what is the shape of the future for downtown Lexington? What will it be like to walk the city streets in 2050?

"First, my guess would be that there will be fewer streets to walk," Brunn says. He foresees that as more and more people flock to the suburbs from the downtown area, a number of downtown streets will be closed and turned into pedestrian zones. "I can imagine a downtown area modeled more along European lines—lots of outdoor cafes, more trees, more green space and gardens, more outside activities in general."

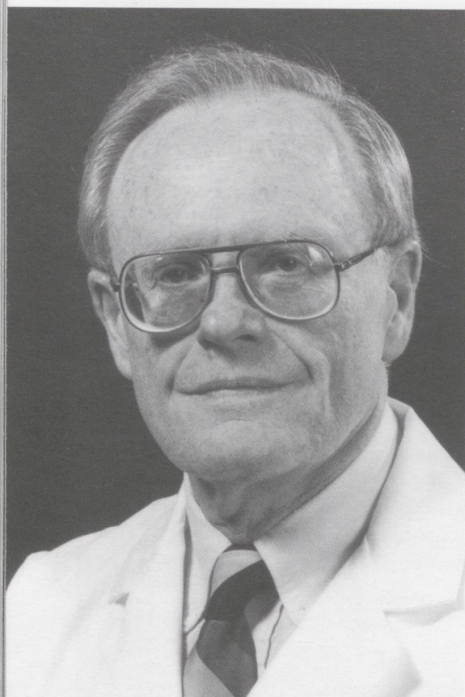
Some businesses will remain, Brunn says, especially those that are service oriented, and he sees an explosion of entertainment and cultural activities taking place downtown. "This transformation will most certainly meet with some resistance from some residents in and near current downtown Lexington," he says, "resistance from those who want to preserve their unique neighborhoods from developers."

"Downtown may transform itself into something of a 'hedonopolis'—all sorts of fun, leisure activities that would also add to Lexington's amenity image," Brunn says. More "club-oriented" activities, he adds,

will probably take place at or adjacent to malls in the outlying areas. "Like it or not," he says, "that's where lots of community social activities may be taking place—sporting clubs, books clubs, music clubs. It's already happening in a more informal way among younger people."

What Brunn shies away from in his future look is any of the wilder scenarios for the future. "Monorails? Jetson backpacks that fly us to work? Moving sidewalks? I don't think so."

As for the automobile of the future, Brunn says that cars will certainly get smaller, but that we will definitely remain an "automobile-centered" culture. "Auto manufacturers have been extremely successful in selling us their version of the American romance: they've made us married to our cars forever." ■



JOHN THOMPSON SAYS THAT SPECIFIC IMMUNOLOGIC TOLERANCE, THE HOLY GRAIL OF ORGAN TRANSPLANTATION, IS WITHIN REACH: "WE'RE MUCH NEARER NOW TO FINDING IT THAN FIVE YEARS AGO—MUCH, MUCH NEARER."

CONTINUED FROM PAGE 31 explains, "and it's certainly very critical in heart, kidney and pancreas transplantation." Cyclosporine is responsible, he adds, for lowering the overall "graft-loss rate" in the past 10 years or so, from around 60 percent to about 25 percent.

A very recent drug that Thompson says is looking "very good in trials" is called T10B9. And Thompson has a special interest in this antibody: he developed it.

"This drug is targeted specifically at those cells in the body that reject grafts, and it looks to be less toxic than previous drugs in its class," Thompson says. T10B9 will enter Phase III trials early next year and will be available, he predicts, in two or three years.

He is excited about recent successes in transplants of various kinds and believes the future looks extremely good for these successes to continue. "Patient survival from heart transplants is now about 89

percent, which is marvelous," he says. "For the liver 80 percent, and lung transplantation is now at about 75 percent. Four years ago," he adds, "there was virtually no success rate with lung transplantation—all the patients died." Thompson explains that transplant "success" is defined as a patient living at least a year after the operation.

As for the future, Thompson is excited about the quest for the "holy grail of transplantation," which would be, he says, something called "specific immunologic tolerance."

"This means permanent tolerance," Thompson explains. "The body wouldn't reject the graft initially nor would it reject it later." The discovery of a drug or other intervention to facilitate tolerance would have clear implications for organ transplants. The patient would be injected with the drug before an operation, and the surgeons could proceed without worry that the body would reject the organ.

How far are scientists from reaching this holy grail? Thompson says that there are many investigators trying out different drugs and schemes to reach this goal.

"I don't mean to be immodest here," Thompson says, "but it may turn out to be T10B9. It's proved itself in ongoing trials to be a much better drug than we expected—better than another 50 or 60 similar drugs that have been tried. It just might turn out that T10B9 is the ultimate advancement."

Attacking arterial plaque with an inner-space probe

In ground-breaking work of his own, UK's Robert Lodder has developed a fiber-optic catheter that is able to cruise through arteries and allow plaque build-up to be measured without invasive surgery. Through Lodder's approach, which he has refined in partnership with his colleague (and wife) Lisa Cassis from UK's College of Pharmacy, he is able to determine the chemical composition of arteries clogged by cholesterol and other debris.

Using a near-infrared process that penetrates water, the catheter, in effect, snaps hundreds of chemical photographs of the arteries. A computer hooked up to the catheter records and analyzes the material as the images inside the artery kaleidoscopically flash on the monitor. These images tell Lodder about the molecular make-up of

*Bacteria and viruses?
There's going to be a continual struggle against the other creatures in this world to see who survives and who doesn't.*

—John Thompson

fatty deposits which choke arteries and lead to atherosclerosis, the nations's number one killer.

There are two advantages to this approach, says Lodder, an associate professor of medicinal chemistry and pharmaceuticals. One is that the amount of plaque present, as well as its molecular make-up, can be determined without cutting into the blood vessel. "Another advantage," he says, "is that we can study living plaque this way—the kind of proteins that are there. Obviously if you go in and take pieces of the plaque out, you can't do this because it's not growing anymore." Lodder emphasizes one very important goal of this research: to shed light on the chemical changes that cause this poorly understood condition.

"People have been putting fiber optics inside arteries for some time now," Lodder says, "so that part of it isn't new at all. What is unique is that we do this near the infrared region where there's a lot of molecular information." For the non-scientists among us, Lodder explains that the "near" in near-infrared means near the visible region of light. Regular infrared light doesn't penetrate water, but Lodder's tiny invention can. "Near-infrared," Lodder continues, "means that the catheter can record images through the water and various substances that cling to the artery walls."

Lodder takes the data that result from the travels of this inner space probe and runs it through UK's supercomputer, which he has found to be indispensable in this work. "One of the reasons Lisa and I came to UK from Indiana University is that there is a commitment here to always having state-of-the-art computing facilities," says Lodder. "And that's the only way we can

CONTINUED ON PAGE 37

Space technology down on the farm

A new high-tech agricultural development may do nothing less than revolutionize farming, says UK agricultural engineer Scott Shearer. But rather than call it "ground-breaking," we should more accurately call it "ground-regulating."

This new space-age approach to farming begins with a series of satellites. From 24 Department of Defense satellites that continually orbit the Earth, a farmer with the aid of a global positioning system (GPS) receiver (these aren't hard to get) can figure out his exact position when, for example, he is fertilizing his field.

The receiver on the tractor is connected to a computer which already has a stored data base of optimal field requirements for fertilization. The computer runs a program that controls the mixing of nutrients for fertilization—nitrogen, phosphorus and potassium—and spreads them as needed as the farmer drives through his field.

"You can see the importance of this if you realize that there are all sorts of soil variabilities within a field," Shearer says. "There are elevation changes, soil type differences, texture variations, rockier areas, and so forth. If a farmer knows exactly where he is, he can coordinate that with the nutrient needs of the precise spot."

The result of this high-tech approach, Shearer says, is a cost savings in the amount of fertilizer used and potential increases in yield, since the crop begins with exactly the right amount and mixture of nutrients.

"This sounds very high-tech," says Shearer, "but it's currently available to farmers throughout the Midwest, and it's now becoming a larger and larger part of farming operations in the southeastern United States. It's happening now."

This system has replaced, for some farm-

ers, what Shearer calls "a generic approach" to fertilizing a field. "The traditional approach involves soil sampling—farmers pull soil samples from several locations within a field to form a single composite sample. They send the sample to a lab for analysis. They know, when they get the analysis back, the average 'fertility values' for the field." An average rate of fertilizer is then applied to the entire field, which results in some parts of the field receiving less than optimum mixtures.

Variable-rate fertilizer application, Shearer explains, will require farmers to grid-sample their fields—that is, to divide the field into 2.5-acre cells and then analyze representative soil samples to determine the fertility needs. "Cell locations and fertility needs are used to generate electronic maps to control the process," Shearer says.

From the advent of computer-controlled fertilization, it's only a slight jump, Shearer says, to what he believes will become more and more commonplace in the farming industry.

"Here are three words for the future of farming," says Shearer: "computer-controlled tractor."

And Shearer isn't talking here about toy tractors; he's talking about full-blown, 20,000-pound John Deeres.

"We're moving from an age where for a long time humans were in control of all machine functions on a farm," Shearer says. "They operated the tractor and the combine. Today we're increasingly moving towards removing people from the control cycle—everything will be done automatically."

Shearer admits that tractors with bumper stickers on the back saying No Driver Aboard are "probably a distance off," but he is clearly excited by the possibility. "If you could automatically guide a tractor and you can run it for 24 hours a day, you could farm a lot more acres and with a much smaller tractor; so the initial tractor invest-

ment would be smaller."

Another obvious advantage of operator-free tractors would be that no one would be injured as a result of tractor overturn. "That's a major farming problem in Kentucky today," Shearer says.

Just how bad is the accident rate among farm families and farm workers? "Agriculture-related accidents are still five times higher in Kentucky than the national average for accidents in all industries," says Larry Piercy, extension safety specialist with the UK College of Agriculture. "Tractor overturns are still the biggest killer on Kentucky farms."

"The technology to do this is here today," Shearer says. "The question is whether, with the initial investment in the technology, we can make it cost effective by today's standards." ■

The American family in the 21st century

Perhaps the word that is going to modify and add more meanings than any other as the years propel us into the future is the word "family." The make-up and the importance of the family in the United States has been the longtime research interest of Johanna Badagliacco, who believes that there will be more and more diverse kinds of families in the future, partnerships that simply won't look like those in the past.

"Part of the reason for this," Badagliacco says, "is economic, or rather the issue of economic independence. It seems to me more and more of the very poorest women aren't seeing much benefit in traditional marriage any more. And given our economy the choice seems to be traditional marriage and children, or economic independence. One or the other." She mentions that we've already seen in recent years a dwindling of family size if, that is, the couple even want children, to the point where we are almost "just replacing the population."

As a result, she says, we will continue to see a broadening of different forms of the family, and at the same time will need to develop a new vocabulary to identify relationships within the family.

"Let's say, for example, that our high divorce rate in the U.S. stays about the same, that half the marriages in the 1990s end in divorce," Badagliacco begins. "Being the people we are, we like marriage so we get married again. We get divorced again. Now if there are children from

all the different marriages, how do they think of one another? Who is this man who is suddenly their third 'father,' this 'step-step dad'? We don't even have the terminology to deal with a scenario like this."

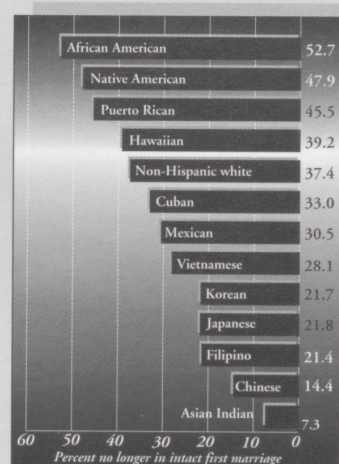
Badagliacco adds that we are getting futher and further away from what she calls the "Ozzie and Harriet Myth."

"Ozzie and Harriet were a myth in the 1950s and they're a myth now," she says. "There is *not* typical American family. There never was. It's a white middle-class myth that simply didn't exist for a lot of people."

Badagliacco says that cohabitation has been a factor in dissolving what may have been our solid ideas about what a family is. About half the couples getting married today, for example, lived together before marriage. This fact has led, in turn, to later marriages, delayed childbearing, and greater diversity.

"The societal ideal of the traditional nuclear family isn't really viable or useful any longer," she says. "And despite our best efforts to dredge it up, it isn't going to exist. There will be, instead, a multiplicity of arrangements—single mothers, single fathers, men and women in fourth marriages bringing their children together. These children, right now, don't even have the language to know how to think of each other."

Percentage of women who had separated or divorced by 1980, among all women who had married for the first time 10 to 14 years earlier, by racial-ethnic group. (Source: James A. Sweet and Larry L. Bumpass, American Families and Households, Russell Sage Foundation, New York, 1987.)



Whatever forms families take, Badagliacco believes that families of the future will be inextricably linked to the community. "In the next 25 years or so we're going to have to recognize the crucial role of community involvement in two different areas," she says. "One is taking care of children. And I think we can't deny that what we will have to have is what some people call 'fictive kin.'" These kin would be friends, neighbors and other commu-

nity members who would, for example, take care of a couple's children while the couple are both at work, Badagliacco explains.

The second community role she mentions is the care of our old and oldest-old, the fastest-growing population group in the country. "We need to think about custodial care by the community for these people who simply may not be able to afford to live in a nursing home, for example. We have to start paying attention to our youngest and oldest citizens in a way we're simply not doing now." ■



JOHANNA BADAGLIACCO SAYS THE OZZIE AND HARRIET TV MODEL NEVER WAS A "TYPICAL" AMERICAN FAMILY: "THAT'S A MYTH. THERE IS NO TYPICAL AMERICAN FAMILY. THERE NEVER WAS."

CONTINUED FROM PAGE 34

figure out from all the signals we get back what kind of proteins and molecules are in an artery."

Taking an imaginative leap into the future, Lodder predicts a time when something like a second or third generation version of his probe will be used to determine, in a matter of minutes, how much plaque a patient has, what it's made of, and what its "failure mode" will most likely be.

Failure mode, Lodder explains, means how the plaque will finally affect the health of the patient. Some plaques ulcerate, spew their contents out, and cause a stroke. Other plaques develop blood clots and others choke off the vessel because they get to be so large. "If you know, for instance, that the plaque is most likely going to keep growing and choke off a vessel by accumulating lipids [fatty compounds], then you can restrict the person's fat intake and give him drugs that lower lipids," Lodder says.

When might such a Star Trek-like magic wand be in use? Is it reasonable to think that the year 2050 would see the first use of such a diagnostic tool?

"2050?" Lodder asks. "No. I think it will happen by the year 2010."

What is a "human being?"

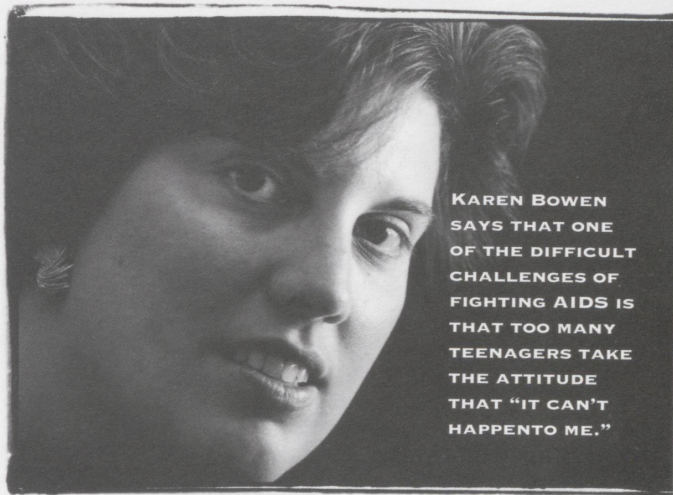
Someone today with a pacemaker or a plastic aorta is still recognizably a human being. Add a set of artificial knees (a routine operation) and a plastic hip (also routine), and the human is still there. And let's say someone has had some bone loss, an entire jaw, perhaps. Surgeons such as Henry Vasconez at UK have already replaced that bone with hydroxapatite, which has the mineral elements of bone but is made from coral.

And since we've gone this far, how about running the clock ahead another 40,000 revolutions to the year 2050, when scientists figure out how to make animal parts biocompatible for use in people.

A baboon heart? Orangutan kidneys?

As the proportion of artificial parts and animal parts rises, let's mix into the formula some findings (from, say, the year 2045) from genetics. It just may be possible, then, through genetic manipulation for a married couple to have doctors give their one-year-old a series of genes so that it turns out she is able—if not to leap tall buildings at a single bound—to run faster and longer than any human before her.

What happens then to the human being's awareness of self, of his or her inner experience? Are we headed toward a future where we will need to redefine what a human being is?



KAREN BOWEN SAYS THAT ONE OF THE DIFFICULT CHALLENGES OF FIGHTING AIDS IS THAT TOO MANY TEENAGERS TAKE THE ATTITUDE THAT "IT CAN'T HAPPEN TO ME."

"I don't think so," says John Thompson, who was willing to respond to this question and so gets the last word. "And my answer has to do with what I think a human being is. I happen to believe the shell we live in is irrelevant. The human being is here," he says, tapping his skull. "This is the person, and no amount of artificial parts or genetic tinkering is likely to change that." ☒



"Wally knows where the nineties are going, but he's not telling."

Researchers at the University of Kentucky Chandler Medical Center are taking the team approach to tackling tough research questions. This year the opening of a new biomedical research facility at the medical center has allowed researchers who traditionally work independently to collaborate with other investigators from varying disciplines on a single health problem.

With the exception of the Combs Cancer Research Center, there has been no major construction of research space at the medical center for over 30 years; despite this, incoming grants and contracts have continued to grow steadily. In the last decade alone, external research funding generated by medical center faculty has more than quadrupled from \$9.9 million in 1985 to \$45.8 million in 1995.

The new, four-story Health Sciences Research Building added 110,000 square feet of laboratory and office space for biomedical research at the medical center. The progressive design and ideology behind the new \$19.5 million building requires that all research conducted within its walls be both molecular and multidisciplinary in nature.

"This is the direction in which science is moving," says Del Collins, vice chancellor for Research and Graduate Studies for the medical center. "The UK Chandler Medical Center will always be based on disciplines, but over time, we will see less of a strict departmental structure and more flex-

ible interaction between departments. The team, or focus-group, approach to research will allow us to become more creative and productive in the research we conduct. We are beginning to see this synergy in the Health Sciences Research Building."

The five focus groups that now occupy the new laboratories are studying neurotrophic factors, cellular and molecular endocrinology, toxicology, the molecular genetics of gynecological malignancies and vascular biology. Eventually, seven focus-groups will share space in the new building.

"To get a nuclear reaction to occur, you must pack the atoms very close together. When you do this an explosion results," says Don Gash, University of Kentucky professor and chair of anatomy and neurobiology. "We are getting an explosion of ideas, productivity and excitement because of our contiguous laboratory space and our collaboration as a group in the new building."

Gash leads one of the focus groups housed in the new facility. His group contains seven members with varying areas of knowledge, from anatomy and neurobiology to pathology, laboratory medicine and surgery. These scientists are studying the mechanisms of trophic, or growth, factors that are among the most powerful naturally occurring substances known to regulate cell survival and function. Scientists and corporations are racing to identify and patent the growth factors our bodies produce.

"At UK, we are working with neurotrophic factors, growth factors that specifically affect nerve cell survival and are trying to learn more about their mechanisms," says Gash. "Clinical trials involving these types of growth factors are already beginning to demonstrate their treatment potential. Over the next 10 years, he says research on trophic factors promises to be extraordinarily productive, not only in understanding the development, growth, regulation and aging of the nervous system, but also in treating disease and injury to the brain and spinal cord.

Gash's studies on the regeneration and recovery of nerve cell function in animals affected with Parkinson's disease received national recognition in 1987. He is continuing his research on Parkinson's in conjunction with the other group members. One member, Kim Seroogy, assistant professor of anatomy and neurobiology, is at the forefront of identifying brain regions and nerve cell populations involved in this disease and possibly in schizophrenia. Other members of the group are using animal models of Parkinson's to study nerve cell transplantation and grafted cell survival and function.

Since the building opened, several research programs have resulted from the team's collaboration. Assistant Professor of pathology and laboratory medicine Kathy Albers, along with Brian Davis, assistant professor of anatomy and neurobiology, has created a group of genetically altered

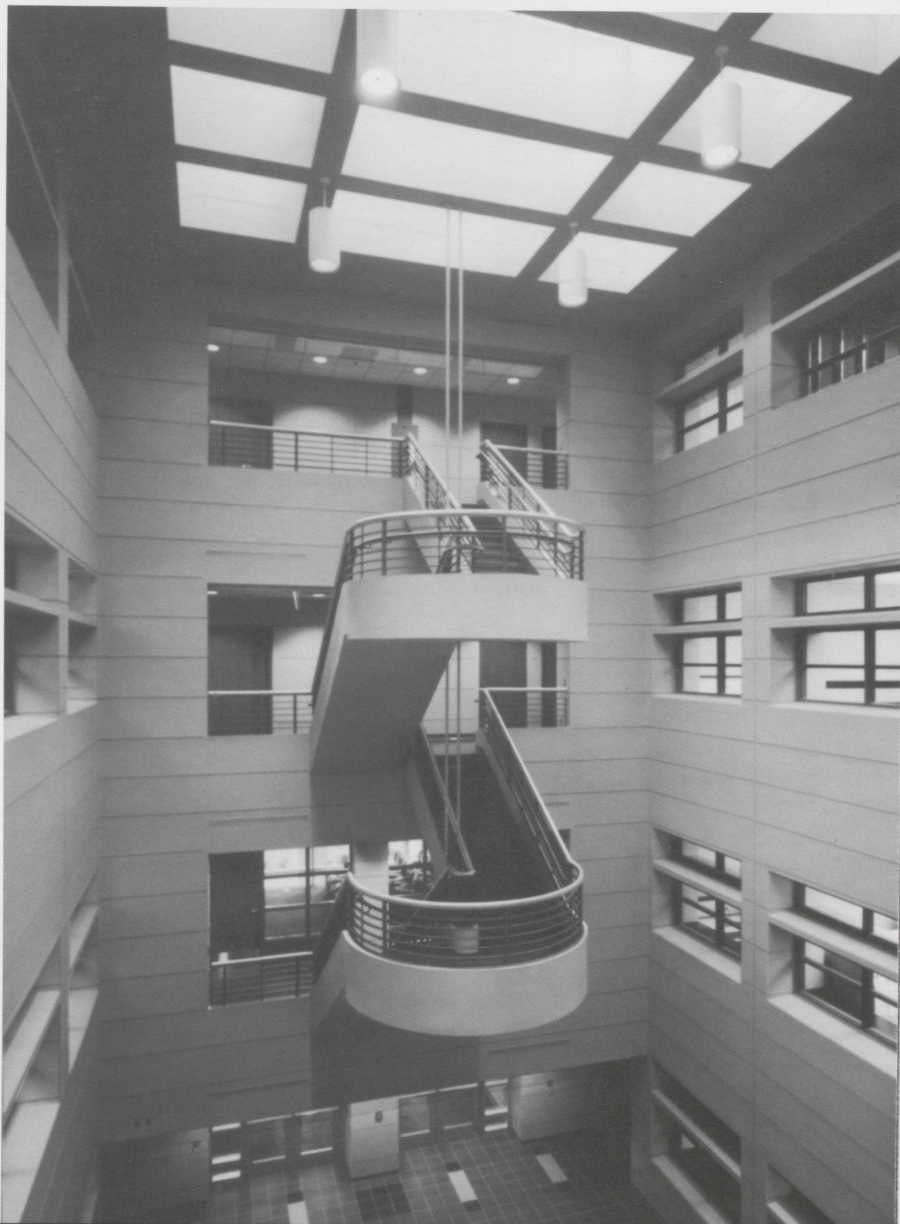
SYNERGIZING RESEARCH TO SOLVE HEALTH PROBLEMS

mice that over-express nerve growth factor.

These animals, for which a patent is being pursued, have been useful to other group members for understanding the effects of nerve growth factor on the developing sensory and peripheral nervous system, as well as for studying the effects of stress on the immune system.

"It is exciting to see the ideas that result from being surrounded by other researchers who bring their own knowledge into a central question. As a group, we are more productive and effective, which is important in our area of research. Some growth factors which were just identified in 1993 are being evaluated for clinical trials possibly beginning as soon as next year. Our collaboration has been a key to generating funding in this area," says Gash.

"The multidisciplinary approach researchers are taking at UK echoes national trends for funding agencies, such as the National Institutes of Health, to increasingly allocate grant support to clinically oriented, collaborative research programs. The Health Sciences Research Building is only the cornerstone to future research construction planned at the medical center," Collins adds. ☐



By Aimee L. Hiller

Seven different focus-groups working on various aspects of molecular research will eventually share space in the new Health Sciences Research Building.

KIOSK

NEW V.P. LIKES WHAT HE SEES AT UK

Fitzgerald Bramwell, UK's new vice president for Research and Graduate Studies, says that one of his several "pleasant early impressions" of Lexington is the ease of getting from Point A to Point B. "I've heard about traffic jams here but haven't been in one yet," says Bramwell, who has been on the job now for a little over five months. "As far as traffic goes, I'm still on New York time; I give myself the same 45 minutes to go from home to the office, but I'm here every day in 10 minutes."

Bramwell, who spent 24 years as a professor and administrator at Brooklyn College, believes that UK is currently one of the best-kept secrets in the research world. "It has a remarkably low profile considering the impressive growth of its research effort over the past five years," Bramwell says. During fiscal year 1995, UK researchers attracted \$116.8 million from external funding agencies. Some \$113 of that is administered through the UK Research Foundation, a nearly 69 percent increase from the \$67 million in the 1990 fiscal year.

"I would like to help lead the university to the next level in terms of research and recognition of its graduate study

mission," says Bramwell, who adds that UK has invested a lot to bring in "better and better" new faculty. "Researchers here have received 35 FIRST Awards," he says. "That's a tremendous indication of how strong our new faculty is." FIRST Awards from the National Institutes of Health provide support for new biomedical investigators to demonstrate the merit of their research ideas. The amount is a maximum of \$350,000 over five years.

By "next level," Bramwell means nothing less than a change in how the University of Kentucky perceives itself—and is perceived—in the academic world. "We need to set our sights on benchmark universities of

international reputation," he says. "I think that's a very reasonable goal." One indicator of UK's status, says Bramwell, is the dramatic rise of funding in the past few years. "Increased funding leads to a number of good things," he says. "It leads, for example, to better university equipment, shared equipment, better faculty attracted to UK in part by this arrangement, and better students attracted by better faculty."

As vice president, Bramwell also plans to emphasize diversity in UK's research programs. "Groups that have been traditionally excluded bring enormous talent to bear on research enterprises when they are included," he says. "The importance of diversity—gender, racial and ethnic—is that it contributes to excellence. You can't

have excellence without diversity."

Bramwell cites the example of an undergraduate's work at Brooklyn College which led to the development of software that is now being used on many of the orbiters going up in space. "That student was an African-American woman," he says. "And another woman student wrote a monograph that has become pretty much the standard for students entering computer science. She did this by the end of her junior year."

Born in Brooklyn, Bramwell attended New York City schools until age 13, when he entered Phillips Academy in Andover, Massachusetts. He earned his undergraduate degree in chemistry from Columbia University in 1966, after just three and a half years there. He received his Ph.D. in

New Vice President of Research and Graduate Studies Fitzgerald Bramwell wants to help lead the university to the next level in terms of research and recognition of its graduate study mission.



chemistry from the University of Michigan four years later.

He is the author of six books and his research has resulted in more than 150 abstracts, papers and invited talks in the areas of organotin chemistry, multidimensional organic conductors, and the structure and reactivity of photoexcited radicals.

Bramwell begins his work at UK with positive impressions. "I like the openness to new ideas I sense here, and I believe UK is not just a good southeastern university: it's a good national university."

As for Lexington, he says it is "very, very different" from Brooklyn. "I saw my first Lexington wildlife last week," he adds, "a rabbit scampering across the yard. The wildlife in Brooklyn is quite different."

—Suzanne Froelich
and Jeff Worley

CONSOLIDATING UK RESEARCH EFFORTS

A new Clinical Study Center at the UK Medical Center is making life easier for researchers and volunteer subjects. The new 13-bed unit on the fifth floor of UK Hospital's north wing has consolidated a number of research efforts while simplifying things for research volunteers, who can now go to one location on campus.

"The new center allows us to do various clinical studies here on important research questions," says Craig McClain, director of UK's General Clinical Research Center. One study currently taking place is focused on a drug called T10B9, which helps keep the body from rejecting organ transplants. This drug was developed at

UK by John Thompson [see also, article titled "Step by Step into the Future: Where is University Research Taking Us?", p. 27], a professor in the Department of Medicine who has been working for 20 years to develop drugs that inactivate the immune system for a time so that such grafts will "take."

Other ongoing studies include work on head injury by Byron Young in the Department of Neurosurgery and research by Philip Landfield in the Department of Pharmacology on calcium metabolism in Alzheimer's patients.

"This is what a university teaching hospital is all about," says William Massie, UK Hospital's chief operating officer. "These days medical technology moves so fast that if you don't keep up you're not able to provide the latest in care."

"A center like this can be very beneficial for the patient," says McClain. "We're testing the newest drugs here, the newest forms of therapy that aren't out on the market yet. So if, for example, somebody has some advanced cancer, some of the best drugs are probably going to be available in a clinical trial such as those that take place through the clinic."

A greater ability to test new drugs eventually could help attract drug manufacturing companies to Kentucky, according to Dan Wermeling, director of the Drug Product Evaluation Unit. A local company that developed a drug could quickly submit it to UK for testing, he says.

COLLEGE OF PHARMACY RANKED THIRD IN NATIONAL GUIDEBOOK

The annual *U.S. News & World Report's* graduate student guide ranks the University of Kentucky's College of Pharmacy third, tied with the University of Minnesota, in its 164-page listing of the "Best Graduate Schools." The guidebook includes listings of various disciplines, admissions requirements and entrance exams, a comprehensive graduate school directory and other information geared towards students seeking a graduate degree.

UK was first ranked third in the publication's top 10 schools of pharmacy in 1993. The colleges are chosen through surveys of the deans and other administrators of accredited graduate programs.



A team of UK engineering students won the national Team Tech competition in which teams of engineering students devise a solution to a real-life industry problem. From left, team members Kristi Maggard, Tricia Wyatt, and team leader Angela Shelly worked with Sargent & Greenleaf assemblers Gracie Napier and Rita Simpson on the project. Sargent & Greenleaf is a locks manufacturer in Nicholasville, Kentucky.

UK ENGINEERING STUDENTS WIN NATIONAL COMPETITION

This year's problem-solving competition sponsored by the Society of Women Engineers posed another interesting conundrum: find a way to better test security locks at the Sargent & Greenleaf plant in Nicholasville, Kentucky.

The 10 students of the win-

ning team designed a machine that tested the locks more efficiently and caused fewer injuries to workers from repetitive motion. The company was so impressed it installed the \$7,000 automatic machine.

"This kind of project requires a lot of time and patience from the students. It's very competitive and demanding," says Janet

CONTINUED ON
PAGE 42

Lumpp, an assistant professor in electrical engineering and the counselor for the student chapter of SWE at the University of Kentucky.

This is the third year in a row UK's chapter has placed in the national competition. It placed second last year and won the year before. Last year's winning project was a laser for Procter & Gamble in Lexington that could detect the level of peanut butter in each jar on the assembly line. The company was having difficulty filling jars consistently when the bottom of the peanut butter vat was reached.

"Winning this competition is really a prestigious honor and is a huge boost for our program. A lot of industry experience and real application like these projects are important for students' careers," Lumpp says.

The UK competitors include Aude Faugere, sophomore, mechanical engineering; Gretchen Gibson, senior, electrical engineering; Meg Hopkins, sophomore, civil engineering; Melanie Latumena, senior, chemical engineering; Monica Latumena, senior, chemical engineering; Krisi Maggard, junior, electrical engineering; Kathy Seinko, sophomore, materials science engineering; Angela Shelley, team leader, junior, chemical engineering; Arasu Subramaniam, sophomore, electrical engineering; and Tricia Wyatt, senior, mechanical engineering.

—Angela Jones

BAGGED VEGGIES ARE BETTER

If you're concerned that by eating packaged vegetables you might be cheating your body out of some important nutrients, there's some good news. Pre-cut veggies might be the best culinary shortcut to quick meals *and* nutrition, says Margaret Barth, a nutritionist at the University of Kentucky.

In her recent research, Barth has found that pre-cut vegetables, such as packaged baby carrots and broccoli florets, better retain their vitamin C and beta-carotene than whole vegetables. The secret is in the packaging.

"Anytime you can buy freshly harvested produce, obviously that is the best source of nutrition. But often the whole vegetables you get at the grocery are not that fresh, and packaged produce might be the best option," Barth says.

After vegetables are harvested, they continue to live, in a sense, feeding off the stored energy in their leaves and stems. When they are exposed to the air, they "breathe" at their usual rate and slowly deplete themselves of all their nutrients. The advantage to packaged vegetables, Barth explains, is the lack of oxygen and carbon dioxide the food receives. This lack helps to slow the rate of depletion and to retain the nutrients for the healthy eater.

In one experiment, Barth discovered that broccoli exposed to the air for four days lost 30 percent of its nutritional value, whereas the protected vegetables only lost 15-20 percent of their nutrients and were greener.

"The food industry is investing a lot of energy into developing unique polymers for plastic packaging that is sensitive to all the varying rates of respiration in different vegetables," she says. Baby carrots, for example, respire or breathe at a slower rate than broccoli. So packaging companies are designing "modified atmosphere packaging," breathable film that considers the different characteristics of produce.

"Companies are really improving their product, especially in overseas shipping. Even though their product is handled more, they are often producing a higher-quality product than the whole vegetables," Barth says.

—Angela Jones

RYE GONE AWRY, OR BREAD TO DIE FOR

Not many people know that what is now just a minor plant disease, ergot, once wreaked havoc on humans in epidemic proportions.

"Holy Fire," or "St. Anthony's Fire," was a fatal disease prevalent in the Middle Ages caused by a fungus still found today in rye grain, says John Hartman, a plant pathologist in UK's College of Agriculture. Victims would go insane and become crippled, as their fingers, toes, arms and legs rotted with gangrene. A sufferer's only relief from the pain was death.

The ergot fungus infects many grain and grass crops but primarily infests rye. "Because rye bread eaters were most prone to Holy Fire, philosophers developed an idea



that God punished them just for being poor," Hartman says. The privileged population ate wheat bread that was not susceptible to ergot.

The military conquests of Peter the Great of Russia, Hartman points out, were squelched when thousands of troops writhed in pain and eventually died after eating bread that carried the fungus.

But rye bread lovers today need not worry about dying for their bread. Hartman says modern agricultural science and dietary diversity help put the scourge of Holy Fire

mostly behind us. Ergot poisoning occurs only occasionally, causing serious illness, but it is no longer a death threat.

Now agricultural researchers know what to look for when spotting blighted rye. It usually has dark, hard fungal bodies that have replaced grains on the rye head. Ergot lives in the soil and in the spring when rye is in bloom, the fungus produces spores that can infect the flowers and developing grain on the plant.

—Jerry Robbins



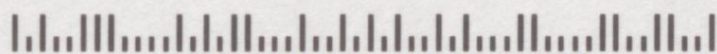
NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO.18 LEXINGTON, KY

POSTAGE WILL BE PAID BY ADDRESSEE

UNIVERSITY OF KENTUCKY
ODYSSEY MAGAZINE
404 KINKEAD HALL-0057
500 S LIMESTONE
LEXINGTON KY 40508-9963



ODYSSEY

Yes, I would like to make a tax-deductible contribution to help keep Kentuckians informed about the importance of research and education to our state.

Please enroll me in *Odyssey* as a:

Business/Corporate Sponsor- ☐ \$500 ☐ \$400 ☐ \$250 ☐ Other \$ _____

Patron- ☐ \$200 ☐ \$150 ☐ \$75 ☐ Other \$ _____

Friend- ☐ \$50 ☐ \$40 ☐ \$25 ☐ Other \$ _____

Name: _____

(Please Print)

Donations will be acknowledged in *Odyssey* Magazine unless anonymity is requested.

Method of Payment:

☐ Check enclosed (Make payable to "University of KY-*Odyssey* Magazine")

☐ Charge my Visa ☐ , Mastercard ☐ Acct. # _____

Exp. Date _____

Signature: _____

☐ Yes, I would like a complimentary subscription to *Odyssey*.

My address is: _____

☐ I already receive *Odyssey*.

RETIREMENT NO ROADBLOCK TO KUC'S WORK ON PLANT IMMUNOLOGY

by Carole Siler

The photographs on plant pathologist Joseph Kuc's desk tell of a grand finale to his distinguished career at UK: Kuc surrounded by a dozen students he has guided to careers in universities and industry around the world. And added to Kuc's long list of honors are the recent Monie A. Ferst Award from Sigma XI and the Pour Le Merite Award from France.

So where has Kuc been Monday through Friday since retiring last July? Back in the office, back in the laboratory, with no signs of packing up.

"Scientists are sometimes very strange people, difficult people to understand," the silver-haired Kuc says with a smile. Each day you work in a laboratory you get information, but you also raise more questions."

Retirement, he says, has only given him opportunity to sleep a little later, read more, and to spend more time thinking about philosophical questions.

During his UK career, Kuc and his research team pioneered work to understand the phenomenon of a plant's immune system protecting it from disease. The results of that work, which began in 1974, and which *Odyssey* reported on in 1982 and 1986, should come to fruition soon. One example is that fields could be sprayed with chemical agents that themselves are not

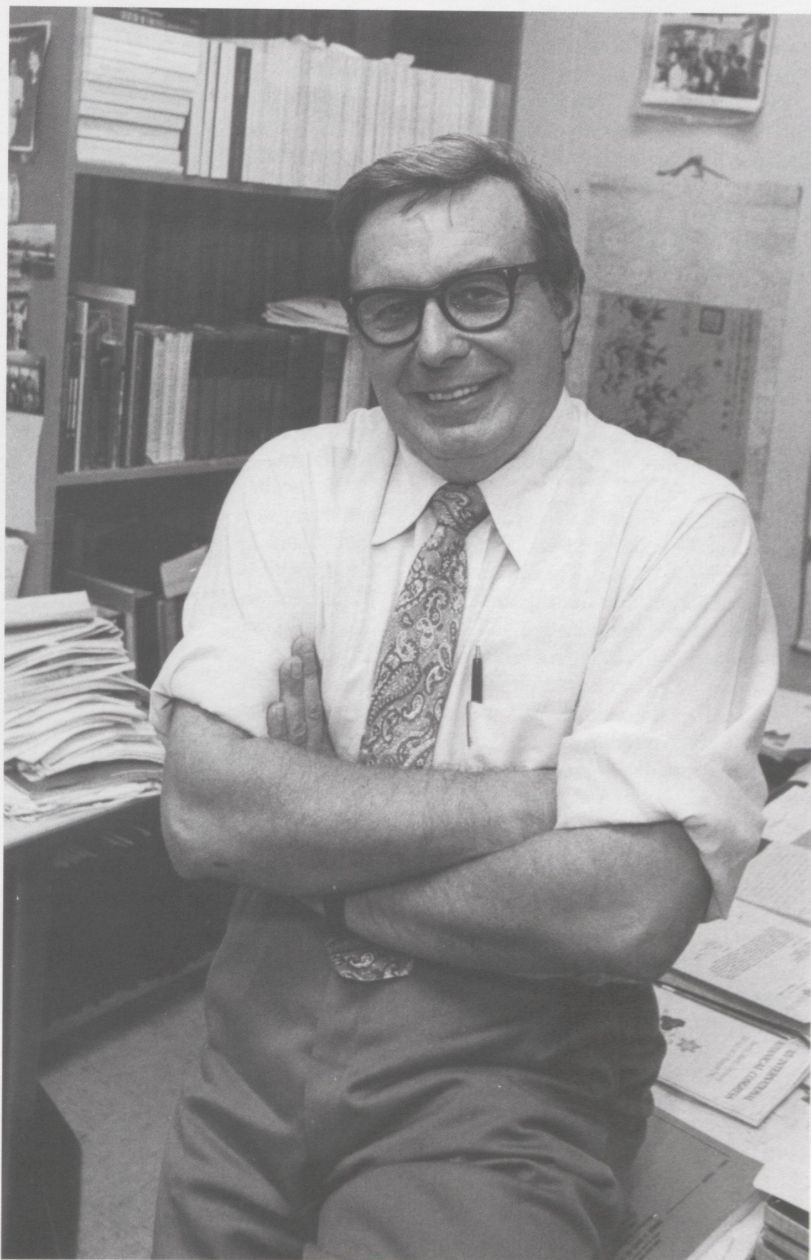


Photo by Ken Goad

JOSEPH KUC, PHOTOGRAPHED IN 1986. KUC'S WORK ON PLANT PATHOLOGY WAS FEATURED IN *ODYSSEY* IN 1982 AND IN 1986.

continued on page 44



UPDATE UPDATE UPDATE

UPDATE UPDATE UPDATE

antimicrobial but that allow the plant to protect itself, Kuc says.

"We need to know the plant's signal transduction pathways, how the genes are expressed, what genes we want to express, and when. We now have technology that wasn't available 20 years ago, and we are in a position to produce plants that are very high-yielding and resistant to disease. Chemicals to immunize plants against disease should be commercialized in a year or so."

Plant immunization technology, which for now offers protection to such plants as potatoes, melons, cucumbers, and tobacco, will also be applied to trees in the future, Kuc predicts.

He counts his scientific achievements as only part of the important work produced through years in his lab. The educational progress of his graduate students and post doctorates, and the information and cultural exchange with visiting scientists from other countries give him great pleasure.

"To read in the journals and reviews about the accomplishments of the people who in some small way you had a role in bringing to a level of accomplishment, well, it's a wonderful thing, difficult to express," he says.

It is also rewarding for a scientist, Kuc says, when other scientists recognize that an idea you had is right. "When you come up with a new idea that goes contrary to what people have been thinking, it is not an easy road to follow. It is ridiculed and people try to tear it down, but when your idea is

accepted and taken up by others, that's very rewarding."

While teaching and research have generally given Kuc pleasure, the grant system has given him pain.

"The grant system, as it now exists, is discouraging individuality and is, in fact, dishonest," he says. "Competition has become so intense for funding that scientists have been forced into making decisions on what they think might be the great breakthrough rather than recognizing that they don't know what it might be. If we knew exactly what experiments we should do and what the results should be, why do the experiment?"

Kuc says he has been fortunate to have had many wonderful scientists on his research teams, "too many to name." But the characteristics he has valued most in them include enthusiasm, dedication, perseverance, curiosity, the ability to see and think. "I would come in in the morning, look around the greenhouse, look at the growth chambers, walk through the laboratories, and I was always pleased when someone would say, 'Professor Kuc, look at this!' I get excited when they're excited. It's not enough to just have information."

Kuc sees the field of genetics supplying us with a lot of surprises in the next century.

"We are doing exciting things to try to understand the function of genes, the expression of genes in medicine and agriculture. We can use bacteria to produce compounds that we need in our own bodies — tremendous breakthroughs in technol-

ogy. This work is fundamental to life and life processes."

His excitement, however, is tempered with concern over megalaboratories, which are in place and will continue to be by the year 2050, he says. "You have projects funded by multi-millions of dollars and many people working on many aspects of a problem, and you have papers published with 15 to 20 authors. With such a large team it is difficult to know who is contributing what. There is also the danger that one or two people will be at the helm having too much of a role in determining the direction of science—what is to be accepted and what is not to be accepted." Directed science could lead to the loss of checks and balances and a loss of individualism, he says. And "if you can't compete with these megalaboratories, you will have to join them."

Despite some misgivings about the future of research into plant pathology, Kuc says he'd do it over again if he had the choice. "If I had to choose a career today I would choose exactly what I have done, and you can't say anything better than that." ■

ON BECOMING A CONTRIBUTOR TO ODYSSEY MAGAZINE

PATRONS

HELPING KEEP KENTUCKIANS
INFORMED ABOUT RESEARCH AND SCIENCE

Odyssey is published because the university feels that your support and understanding of the importance of UK research activities are critical—now perhaps more than ever.

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 can reach a potential audience of 1.4 million readers—letting them know of some of the advances that have been made through research, of opportunities for their children in research and science careers, and of particular programs where UK research has made life better for them and their families.

Please take a few minutes and complete the card in this magazine, indicating your support and interest in helping us to continue to get out the message of why and how research and graduate education is important to our state. Your support would be deeply appreciated as is the support of the following individuals who are recent contributors to *Odyssey* Magazine.

Patrons

Boeing Corporation
John R. Fisher, Seattle, WA
Elissa May-Plattner, Melbourne, KY

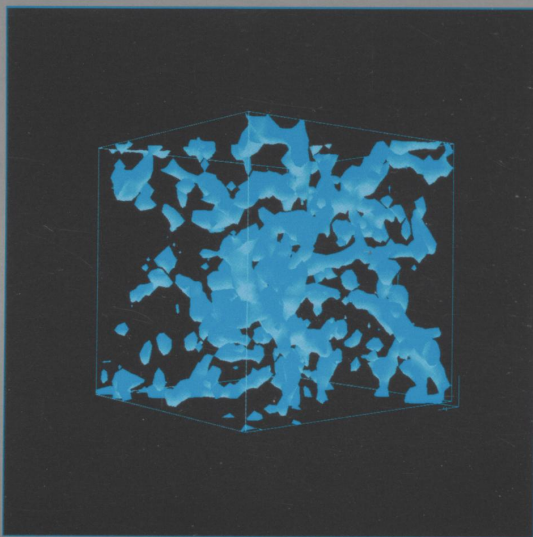
Friends

Dr. and Mrs. W. L. Boswell, Versailles, KY
Ms. Rose Mary C. Brooks (Mrs. William O.),
Lexington, KY
Woodrow W. Deaton, Lexington, KY
Johnson and Johnson
R.D. Johnson, Lexington, KY
R. Chontrelle Layson, Millersburg, KY
Lorraine Lollis, Lexington, KY
Terrell L. Noffsinger, Auburn, KY
Charles D. Pringle, Harrisonburg, VA
Nancy Rayburn, Louisville, KY
Robert and Louise Reithel, Clovis, NM
Anne R. and J. J. Ryan, Jr., Lexington, KY
Thomas H. Shelley, East Brunswick, NJ
Rosalea Sisk, Fulton, KY
J. Montjoy Trimble, Lexington, KY

ODYSSEY

Communications and Advancement
Kinhead Hall
Vice President for Research and Graduate Studies
University of Kentucky
Lexington, Kentucky 40506-0057

NONPROFIT ORGAN.
U. S. POSTAGE
PAID
Lexington, KY
PERMIT NO. 51



*A simulation
performed on UK's
Convex Exemplar Supercomputer. See article
titled "Exploring Cyberspace," page 13.*

RECYCLED  PAPER

