

• THE MAGAZINE OF UNIVERSITY OF KENTUCKY RESEARCH • SUMMER/FALL 1992 •

ODYSSEY



10TH ANNIVERSARY ISSUE

ODYSSEY: Ten Years of Highlighting UK Research

The idea of publishing a magazine devoted to University of Kentucky research began developing in 1980. We knew that there was a tremendous amount of important and significant work underway by our faculty and that much of it was having a profound impact throughout our state and often throughout the nation. This work was, unintentionally we felt, a well-kept secret. We didn't want it to remain one.

The commitment was made to increase the information available to the public on UK's research program, and it was decided that a magazine would be one of the ways we could accomplish this goal. After cutting back several other publications to enable us to have the resources to proceed with the magazine, we tinkered with design for a while—finally settling on the current format and the name ODYSSEY. Our first issue was published in the spring of 1982 and was met with very favorable reviews by our readers, colleagues at other institutions, and by UK faculty and staff. ODYSSEY was off and running!

Like most things in life, a magazine evolves and develops—and ODYSSEY has undergone many fine tunings and adjustments since 1982. In this issue, there are several changes—all of which are intended to make the magazine more readable, more interesting to you. Hopefully, in the years to come ODYSSEY will continue to reflect new approaches and embrace fresh ideas.

From a personal vantage point, this has been a growing, learning 10 years for me as editor of ODYSSEY. With every issue, there are many more research projects that deserve to be featured than we have room for. While it can be frustrating not to be able to tell you about every interesting project, the research we do publicize is testament to the depth and breadth of work going on at this institution.

This issue is considerably different than past issues of ODYSSEY in terms of content. Instead of featuring a selection of research projects, we are addressing questions under discussion in many parts of Kentucky as well as in our nation—"How do research and teaching re-

late?" and "What benefits are we getting from the research?" The voices you will hear on the following pages include those of experts outside the state as well as undergraduate and graduate students from the University of Kentucky, faculty from other Kentucky universities and schools, and our own UK faculty.

Research is often a long drawn-out process. It takes a tremendous commitment to spend the vast amount of hours, weeks and years needed to explore new areas and to create solutions for many of today's problems. Yet underlying that commitment is an excitement on the part of the faculty researcher and that excitement is contagious.

I catch it all the time—almost every time I walk into a laboratory or faculty office and hear about new ideas and projects. More importantly, this excitement is contagious to the students.

Students sense the enthusiasm of our faculty researchers, who can make very difficult, complex subjects fascinating and understandable to them. After all, students are in the enviable position of learning from the people who are creating this knowledge and these innovations—the faculty.

While this issue of ODYSSEY approaches the subject of research and teaching more directly than past issues, the link between the two—evident in every issue of ODYSSEY—is an important one, and its impact reaches far beyond the borders of the commonwealth.

The fine staff of ODYSSEY and I hope you enjoy this anniversary issue. And, particularly, we hope you, too, catch the feeling of excitement about the

many accomplishments of our UK faculty researchers and realize the great promise their work holds for the future.

Susan Hodgetts Stempel
Editor, ODYSSEY
Director, Communications & Advancement

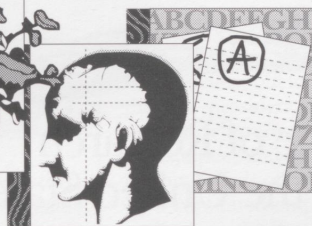
[Due to space constraints two regular features are not included in this issue—"Behind the Scenes" and "BRAVO—Stellar Students, Premier Placements." They will, however, appear in the next issue of ODYSSEY.]



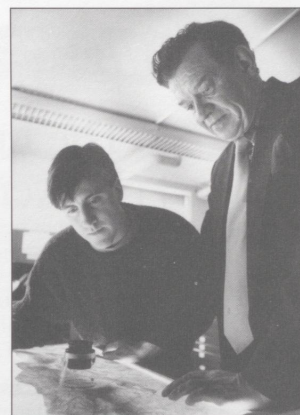
ODYSSEY staff: (from left to right) Suzanne Froelich, staff writer; Jeff Worley, associate editor; Susan Hodgetts Stempel, editor; Teresa Shear, designer; and Lisa Lizer, publications assistant.

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ODYSSEY



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of the Mandate,*
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Volume X, No. 1

ODYSSEY is published by the Office of the Vice President for Research and Graduate Studies. Each issue of ODYSSEY describes only a few of the many University of Kentucky research projects underway in a variety of areas.

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A Backward Glance:



The Emergence of Research Universities in the United States

By Jeff Worley

The character of the American university has changed considerably since the first college was planted on this continent over 350 years ago. In responding to various expectations and urgencies, American higher education has moved through three distinct, yet overlapping phases.

The colonial college, with its strong British roots, took a view of college life that focused on the student—on building character and preparing new generations for civic and religious leadership. One of the first goals the English settlers of Massachusetts pursued, according to a description of the founding of Harvard College in 1636, was to “advance *Learning* and perpetuate it to Posterity.” *

The colonial college was expected to educate

and morally uplift the coming generation. Teaching was viewed as a vocation—a sacred calling—an act of dedication honored as fully as the ministry. In fact, what society expected of faculty was largely dictated by the religious purposes of the colleges that employed them. Students were entrusted to tutors responsible for their intellectual, moral and spiritual development. According to historian Theodore Benditt, “professors were hired not for their scholarly ability or achievement but for their religious commitment.”

This tradition, one that affirmed the centrality of teaching, persisted well into the 19th century. Young scholars continued to be the central focus of collegiate life, and faculty were employed with the understanding that they would be educational mentors, both in the classroom and beyond.

But change was in the wind. Higher education's focus gradually began to shift from the shaping of young lives to the building of a nation. The idea that Americans should strive to build a better world began to come into prominence.

In 1846, Yale University authorized the creation of a professorship of “agricultural chemistry and animal and vegetable physiology.” In the same decade, Harvard president Edward Everett stressed his institution's role in the service of business and economic prosperity.

The practical side of higher learning was remarkably enhanced by the Morrill Act of 1862, later called the Land Grant College Act. This historic piece of legislation gave federal land to each state, with proceeds from sale of the land to support both education in the liberal arts and training in the skills that ultimately would



Physiology classroom, 1897-98, shortly after the university began admitting women



undergird the emerging agricultural and mechanical revolutions. In Kentucky, this legislation had a direct and almost immediate consequence: the founding in 1866 of Kentucky's A&M College, a component of the one-year-old Kentucky University.

The Hatch Act of 1887 added energy to this effort by providing federal funds to create university-sponsored agricultural experiment stations that brought learning to the farmer, and the idea of education as a democratic function to serve the common good was planted on the prairies. Kentucky University president James K. Patterson, two years before the Hatch Act was signed into law, had already convinced the university board of trustees to create an agricultural experiment station. The General Assembly approved the board's action, awarding the station state funds and giving it the obligation to serve the state's farming interests by testing commercial fertilizer.

By the end of the 19th century, American education, once devoted primarily to the intellectual and moral development of students, added *service* as a mission, and both private and public universities took up the challenge. In 1903, David Starr Jordan, president of Stanford University, declared that the entire university movement in the 20th century "is toward reality and practicality." By 1908, Harvard president Charles Eliot could claim: "At bottom, most of the American institutions of higher education are filled with the modern democratic spirit of serviceableness."

Skeptics looked with amusement, even contempt, at what they considered the excesses of utility and accommodation. Some even viewed the agricultural experiment stations as a betrayal of higher education's mission. They ridiculed the "cow colleges," seeing in them a dilution of academic standards. Others recoiled from the idea that non-elite young people were going on to college.

The idea that professors could spread knowledge that would improve agriculture and manufacturing gave momentum to what later became known as applied research. In the 1870s and 1880s, many agreed that education was, above all, to be considered useful. Over the next 30 years, these agricultural sciences developed at a rapid pace, vastly increasing the knowledge that scholars could apply.

Service during this expansive period had a moral meaning, too. The goal was not only to serve society, but to reshape it. Andrew White, the first president of Cornell University, saw graduates "pouring into legislatures, staffing the newspapers, and penetrating the municipal and county boards of America." In this era marked by a continued emphasis on liberal education and values, the faculty's role was energized by determined efforts to apply knowledge to practical problems.

Basic research, which can be traced to the first years of the Republic, also began to take hold. Our country's earliest research effort had been led mostly by investigators outside the academy—people such as Thomas Jefferson; the mathematician Nathaniel Bowditch; the pioneer botanists John and William Bartram; and the perseverant astronomer Maria Mitchell, who set up an observatory on lonely Nantucket Island and, on one October night in 1847, discovered a new comet.

Still, colleges themselves were not wholly devoid of scientific effort. As early as 1738, John Winthrop of Harvard, the first academic scientist, had a laboratory in which to conduct experiments. However, this change to research experimentation at the college itself came slowly: when Benjamin Silliman became the first chemistry professor at Yale in 1802, there were only 21 other full-time scientific faculty positions in the United States.

At Kentucky University, the first research project was carried out almost as soon as the doors of the institution opened. In 1866, a stranger from Pennsylvania, G.W.N. Yost, appeared before Regent John B. Bowman seeking the help of faculty and students in testing a farm machine he had invented. Yost's proposal can be called the first research contract UK received. In gratitude for the help he was given, Yost gave the college the sum of \$25,000, an astonishing amount when translated into 1992 equivalents.

The research mission the university assumed from its beginning was also exemplified in other fields. In the 1890s, the university pioneered in

The colonial college was expected to educate and morally uplift the coming generation. In fact, what society expected of faculty was largely dictated by the religious purposes of the colleges that employed them.

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*Basic scientific knowledge
came to be regarded as the foundation for
the achievements of applied science during the war.*

the new field of X-rays. Merry L. Pence and Joseph W. Pryor, M.D., studied scientific journals and, guided by them, built an X-ray machine. Pryor used it for his research into the anatomy of the hand, and he placed their machine at the service of the Lexington medical profession.

By this time, late in the 19th century, a number of Americans had gone abroad to study in Europe and were profoundly influenced by the research orientation of the German university and wanted to develop a similar model here. G. Stanley Hall, first president of Clark University, wrote in 1891, "The German University is today the freest spot on earth . . . Nowhere has the passion to push on to the frontier of human knowledge been so general." Some, it is true, resisted the German influences. The prominent American humanist Irving Babbitt argued that the Ph.D. degree led to a loss of balance. He complained about the "maiming and mutilation of the mind that comes from over-absorption in one subject," declaring that German doctoral dissertations gave him "a sort of intellectual nausea."

Still, research and graduate education increasingly formed the model for the modern university. And to men like Daniel Coit Gilman, who introduced the term "research" to American higher education in 1906, this European model called for a new kind of American

university, one based on the conviction that knowledge was most attainable through research and experimentation. Acting on this conviction, Gilman founded Johns Hopkins University in 1876, a step described by sociologist Edward Shils as "perhaps the single, most decisive event in the history of learning in the Western hemisphere," since Gilman was the first to "transplant," successfully, the German university model to American soil.

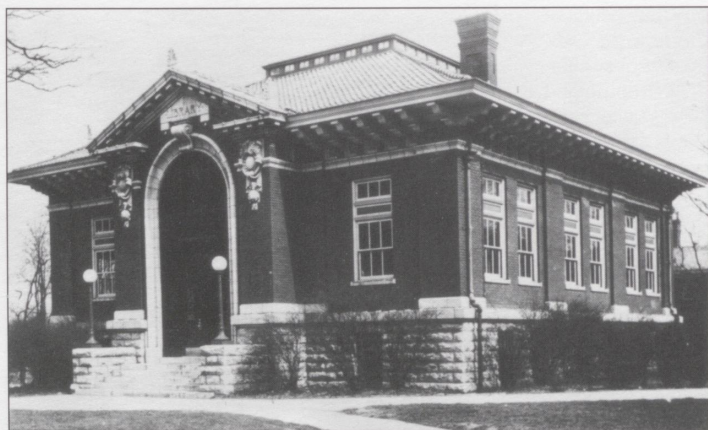
So by the turn of the century, the advancement of knowledge through research had taken firm root in American higher education, and colonial college values, which emphasized teaching undergraduates, began to lose ground to the new university that was emerging.

In contrast to European university professors, however, American professors who wanted to undertake research projects had to scramble for the necessary funds. Chair appointments for European professors typically included direct support for research institutes or seminars. Before 1900, it was common for American professors to pay these extra expenses out of their own pockets.

A true research economy did not come into existence until the 1920s. The stimulus for this development was the war-related research conducted by scientists during World War I.

American scientists had been mobilized during the war to perform a wide variety of tasks, of which antisubmarine warfare was probably the most scientifically challenging. Scientists not only performed these tasks effectively, but their accomplishments seemed to vindicate past investments that had gone into building up academic science. Basic scientific knowledge came to be regarded as the foundation for the achievements of applied science during the war. In the United States, at least, this was a monumental realization. "For the first time in history," according to internationally renowned American physicist Robert Millikan, "the world has been waked up to an appreciation of what science can do."

Universities in the 1920s began to view industry as a source of revenue for research work—the role of industry should be to support the universities and then reap the eventual harvest of practical results. After the war, in fact,



*Carnegie Library, the library of
the University of Kentucky from 1909 to 1931*



UK receives experimental electronic digital computer kit in 1957 from IBM: (left to right) Henry Simpson, IBM; Dan Terrell, dean of the College of Engineering; Walter Crabbe, IBM; H.A. Romanowitz, head of UK Department of Electrical Engineering.

MIT made an explicit commitment to work closely with industry. The MIT "Technology Plan" encouraged contributions by businesses, giving them access to MIT's facilities, personnel and expertise. A Division of Industrial Cooperation and Research, set up to administer industrial contracts in conjunction with the plan, became a permanent fixture—the first university office of grants and contracts.

As the Great Depression gave way to a devastating war, another watershed in the development of the university research system was reached. Vannevar Bush of MIT and James Bryant Conant of Harvard volunteered the help of the universities in bringing victory to the nation. In 1940, Bush took the lead in establishing the National Defense Research Committee which, a year later, became the Office of Scientific Research and Development. Academics flocked to Washington to staff the new agencies, and federal research grants began to flow. Universities and the nation had joined in a common cause.

Remembering the growth of higher education in the years following World War I, and anticipating another such time of growth after World War II, the University of Kentucky planned for the future as the war was ending. The administration thought in terms of both undergraduate and graduate education, and at the

same time of research activity. In 1946 the Kentucky Research Foundation was established to oversee an expected increase of outside funding for research and expansion of gifts for scholarships and university development. It was evident that the federal government, which had been granting money to universities for a long time, would participate on an unprecedented scale in supporting university research.

A few years after the war, with the help of the G.I. Bill, a veritable army of freshly minted Ph.D.s fanned out to campuses across the country. These young scholars sought to replicate the research climate they themselves had recently experienced. In just a few decades, priorities in American higher education were significantly realigned. The emphasis on undergraduate education, which throughout the years had drawn its inspiration from the colonial college tradition, became overshadowed by the European university tradition, with its emphasis on graduate education and research.

According to Roger Geiger, professor of education at Pennsylvania State University, the current climate

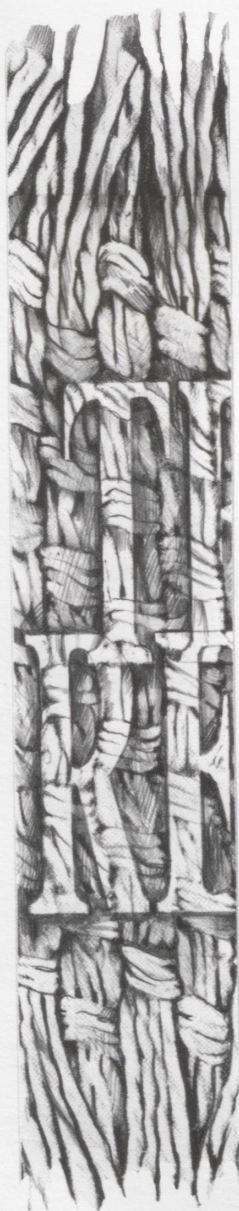
Higher education's focus gradually began to shift from the shaping of young lives to the building of a nation.

seems to be ripe for universities to convey the hope that science will contribute to resolving the current economic malaise, to spread faith in the efficacy of basic research to provide us with more knowledge, more alternatives, and more flexibility to deal with future challenges. ♦

*[Information for this article was taken from Scholarship Reconsidered: Priorities of the Professoriate, Ernest Boyer, The Carnegie Foundation for the Advancement of Teaching (Princeton, NJ), 1990; "Milking the Sacred Cow: Research and the Quest for Useful Knowledge in the American University since 1920," Roger Geiger, Science, Technology & Human Values, 13, Nos. 3 & 4, Summer & Autumn 1988; and As We See It: Recollections on the Emergence of Research & Graduate Education, Susan H. Hodgetts, ed., the University of Kentucky (Lexington, KY), 1990.]



Research vs. Teaching



Ivory Tower Elitists, the Six-Hour Workweek, and Other Myths about the Professoriate

by Jeff Worley

It's an old debate, one that re-emerges from time to time on the venerable dais of higher education: research vs. teaching. And as the American research university settles into its second century of existence, it has, once again, been called on the carpet to explain itself.

From UCLA to Harvard, with stops in between, the issue of how faculty apportion their time has gained momentum, and criticism has come both from the general public and from within research universities themselves.

UCLA Chancellor Charles E. Young bluntly stated recently that there is an imbalance between teaching and research. "I don't think it's a great imbalance, but in the last few years there's been kind of an erosion in terms of the amount of time and effort devoted to undergraduate teaching." "The quality of education and teaching is at risk in a research university," said Harvard's former president Derek Bok in the fall of 1990, "because the rewards of society are so powerful in the direction of research."

In responding to what he characterizes as an unprecedented volley of criticism fired at American research universities in recent years, David Riesman, a professor

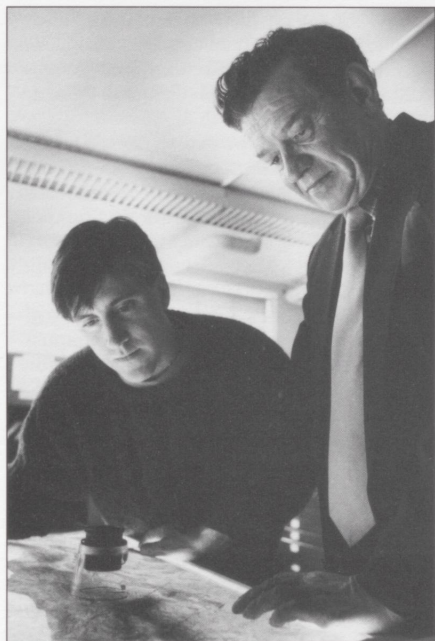
"Personally, I don't want to be taught by somebody who has not continued to learn."

—David Riesman,
professor emeritus of sociology at Harvard

emeritus of sociology at Harvard who is well known for his studies of American higher education, warns against what he calls the "anti-intellectual" nature of some of the calls for reform, particularly in what he sees as a tendency for "simple-minded dichotomies" of teaching versus research. "I worry about this rhetoric," he says, "and all this talk that there's . . . too strong a focus on research. Personally, I don't want to be taught by somebody who has not continued to learn."

"...lots of professors on campus" would consider a 53-hour workweek light duty.

—Nicholas Rast,
UK Hudnall Professor of Geology



Nicholas Rast (right) with graduate student Peter Goodman, a Chevron Fellow who hopes to complete his Ph.D. in geology in the summer of 1992

Closer to home, several broadsides have been fired at Kentucky's flagship university, the criticism focused primarily on faculty workloads and the quality of undergraduate education at the University of Kentucky.

The "Six-Hour Workweek"

How can faculty meaningfully engage students, the question runs, if professors are so seldom in contact with them?

The issue of how faculty spend their time isn't new. In a recent monograph, *Faculty Workload, Research, Theory and Interpretation*, Harold Yuker notes that the first study of faculty workloads was done in 1919. Research and fiscal analyst Daniel Layzell, in a recent article

titled "Tight Budgets Demand Studies of Faculty Productivity," says that a number of studies have been done since that time by individual researchers, institutions, state boards of higher education, and state governments. The overall results of these studies, interestingly enough, have varied little over time.

In general, Layzell says, full-time faculty members are found to work from 50 to 65 hours a week, with approximately half of their time devoted to instructional activities—preparing for classes, grading papers and administering tests. A recent report by the National Center for Education Statistics, "Profiles of Faculty in Higher Education Institutes, 1988," indicates that in the fall of 1987 full-time faculty members at all institutions worked an average of 53 hours a week and spent 56 percent of their time in instructional activities.

Nicholas Rast, UK Hudnall Professor of Geology, says that "lots of professors on campus" would consider a 53-hour workweek light duty. "In the fall, I taught two courses, involving every week six hours in the classroom, between 10 to 15 hours of lecture preparation, and three to four hours of advising students in my office. I spent three weekly hours on my administrative duties and up to 40 hours on research, divided between time allocated to my own investigations and time allocated to four or five graduate students."

Rast may well be right about UK faculty effort. According to the 1991 Self-Study Survey of faculty, staff and students at UK, of faculty involved in teaching 61 percent spent from 11 to 30 hours on instructional activity (a few worked more than this), and 49 percent of professors involved in research worked 11-30 hours on research projects. Thirteen percent of those conducting research put in even more time—31 hours a week or more. When time spent on public service, administration and professional development is added, a 60-hour workweek becomes commonplace for many professors.

"Recent charges that UK professors work six-

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"Teaching begins with what the teacher knows. Those who teach must, above all, be well informed, and steeped in the knowledge of their fields. Teaching can be well regarded only as professors are widely read and intellectually engaged."

—Ernest Boyer,
president of the Carnegie
Foundation for the
Advancement of Teaching

*"Research and teaching are like sinning and confession.
If you do not do the first, there is no need for the second."*

—William Harris, president of Texas Southern University



*Louis Swift, the College of Arts and Sciences'
Distinguished Professor for 1991-92*

hour weeks seem to have given rise to a comparison I've heard around campus recently," says Louis Swift, dean of University Studies at UK. "The analogy has been put forward that Rick Pitino, on a typical week, coaches two basketball games. Each game takes about three hours, so he's spending only six 'contact hours' a week doing his job. So shouldn't he also be coaching tennis, maybe golf as well? Like Pitino, UK professors spend quite a lot of time preparing to do the best job they can."

Robert Hemenway, chancellor of the Lexington Campus, says that a UK faculty member, on the average, works about 56 hours a week. But how many hours faculty work, he says, is "the wrong question."

In an article published in the *Lexington Herald Leader* in early March, Hemenway says that what should be asked is this: What is the quality of education students receive? "Calculating faculty labor by counting hours is like judging your minister on time spent preaching. Ministers, like faculty, are trained to organize their workweek around their public performance. There is a public ministry on Sunday, and preachers spend hours preparing for their parishioners, just as faculty do for their stu-

dents." University faculty, Hemenway adds, are like ministers: "Teaching is a calling, and faculty endow and inspire each new generation with knowledge, challenging them to make a better world."

Swift has a thing or two to say about the quality of instruction at UK. He recently chaired a committee to select final candidates for the Chancellor's Awards for Outstanding Teaching at the university. Swift says he found this committee assignment to be "one of the most difficult in my 21 years at UK."

"The Chancellor's Awards recognize top-notch teaching on the Lexington campus," says Swift. "There we were, sitting around a table going through 71 nominations—71! And as we reviewed and discussed them, we kept saying, 'These people are all so good! How can we make these decisions?' I don't think people realize that there's a great deal of excellent teaching that goes on here."

Swift believes that research and teaching are complementary, not antithetical. "It seems to me that one of the reasons we want to make sure professors are involved in research is so that they are intellectually alive. If you want to keep current, to bring students up-to-date information, you have to do research." Swift adds that the impact in the classroom may be immediate—a discovery in the lab that students can be shown during the next class period, or it may be more gradual—developing a new attitude toward the work of Virgil or Goethe. "But," says Swift, "there's no question about the fact that research influences teaching in a positive way."

The Research/Teaching Link

From the time the first "research university" opened its doors in 1876 [see article titled, "A Backward Glance: The Emergence of Research Universities in the United States," p. 2], research has been envisioned as a companion to instruction. It's reasoned that a faculty

member who is also a practicing explorer is better equipped to lead the next generation into the frontiers of knowledge. "It's different being taught by a teacher, versus being taught by a discoverer," says Benjamin Ware, vice president for research at Syracuse University, who describes a predisposition to insight that can be imparted only by a researcher. "At a research university, we want to develop students who, rather than just reciting facts that we've given them, can look at a body of knowledge, see what's missing, and focus on what remains to be asked."

Even Ernest Boyer, president of the Carnegie Foundation for the Advancement of Teaching and a leading critic of what he sees as the misuse of faculty talent in American colleges and universities, agrees that all faculty should establish their credentials as researchers [Boyer prefers the term "scholarship," which, he says, includes discovery, integration, application and teaching, to the term "research"]. "Whether or not they choose specialized, investigative work on an ongoing basis, every scholar must, we believe, demonstrate the capacity to do original research, study a serious intellectual problem, and present to colleagues the results."

The "Enthusiasm Factor"

In addition to bringing current information and perspectives into the classroom, researchers-as-teachers can enliven the classroom with a constantly renewed enthusiasm, says Jeffery Bieber, assistant professor in UK's Department of Educational Policy Studies and Evaluation. "Even if researchers can't discuss the work they're doing with, say, an undergraduate class, they can still spark the group with some of the enthusiasm and vitality they bring to the research project. That's one thing that I think is too often overlooked in evaluating the classroom experience—the demonstration of this love of learning."

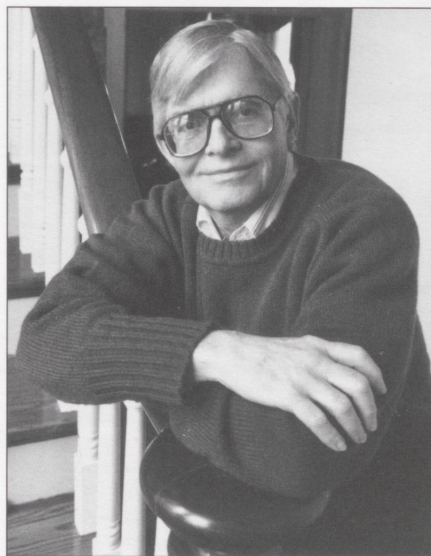
David Watt, UK professor of pharmacy and chemistry, had a choice between working in the pharmaceutical industry or teaching. He chose teaching. "Teaching combines the chance to do research in organic chemistry alongside undergraduates and graduate students with the opportunity to show these students what I find fascinating about my discipline." Watt, who

won a 1991 Great Teacher Award, believes that great teachers can't exist without great students. "The students here at UK press me to answer difficult questions and generally won't settle for anything less than a solid answer to those questions."

Researcher/teacher interaction with students in the classroom can be particularly effective when the research is linked to the teaching. "Research universities must always watch to see that the research that is a part of their self-definition is available to undergraduates," says Jay Oliva, president of New York University.

As part of their learning experience, undergraduates at a number of American universities have been working alongside researchers in programs specifically designed to show students what research is all about. A recent study by the Association of American Universities listed roughly two dozen member-schools with

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Raymond Betts, director of the UK Gaines Center for the Humanities



"We want to help them [undergraduates] learn how to organize their thoughts, collect and assemble data and make some conclusions. In today's marketplace, if people can't do that they aren't going to be competitive."

—Allan Butterfield, UK professor of chemistry

"Most of our faculty are here at the university rather than at research institutes because they have an interest in teaching and in students—it's as simple as that."

—Jim Boling, UK associate dean of research, College of Agriculture



Jay Allen, with a model of the 17th-century Spanish theater

ongoing undergraduate research initiatives. The University of Kentucky, hoping to excite students about science and encourage them to major in scientific fields, has joined the growing number of universities that have developed research programs for undergraduates. In 1987 UK initiated a Research Education for Undergraduates (REU) program so that, as University Research Professor Robert Dickson says, "undergraduates can have a chance to see what research is like."

Allan Butterfield, professor of chemistry at UK, says that it's important in lots of ways for researchers to work as teachers of undergraduates. "We want to help them learn how to organize their thoughts, collect and assemble and evaluate data and make some conclusions," says Butterfield, who has worked with "40 to 45" undergraduates on independent study projects. "In today's marketplace, if people can't do that they aren't going to be competitive."

"A Good Question"—Students Inspiring Research

The initial impulse for discovery "is of two directions," says Raymond Betts, professor of history at UK, who points out that an added bonus of teaching is the intriguing question from a student that can send the professor off on a research mission.

"I think there's a 'silent dialogue' between teaching and research," Betts says, "and it's a dialogue that benefits teachers and students. Students often come to a body of knowledge with a fresh perspective; their questions might point up a lack of understanding about some facet of a subject that needs to be investigated."

Daniel Reedy, dean of the Graduate School at UK, agrees. "It's something the good teacher just loves to get: the question he can't answer. The answer may be found in the research of others, or it may be such an original question that there isn't any research that can help find the answer."

It was a student's question, in fact, that sent Jay Allen, chairman of UK's Spanish and Italian Department, off to Madrid, Spain. Allen was teaching a course in 17th-century Spanish theater at the University of Florida in 1979. In order

for students to better understand Spanish plays of that time, Allen asked them to act out various scenes. Wanting a realistic sense of stage and audience, a student asked, How big was the theater at this time?

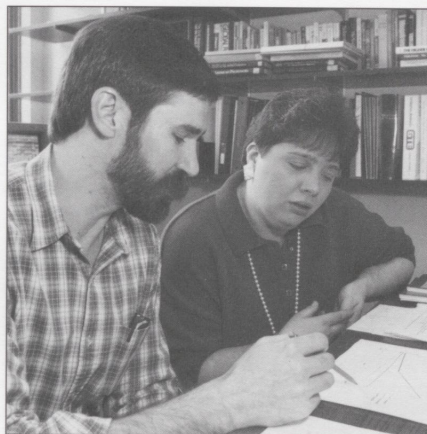
"That's a good question," Allen remembers saying. So he did some library work, only to find that "there was little information on the subject, and what there was contradicted itself." Allen's relentless search to discover how the theater looked took him to the Madrid archives a few years later and led him, eventually, to write and publish a book on these open-air theaters of Spain's "Golden Age." His studies have been compared to studies of the Old Vic and the Globe Theatres in England, and Allen is now considered to be one of the world's leading experts on the staging of 17th-century Spanish drama.

Other Stereotypes: Professors Deadwood and Esoteria

But perhaps Allen's enthusiasm and perseverance are the exception, not the rule at research universities. What about, some detractors might say, all the "deadwood"?

"Of all the misperceptions of professors—I'm thinking of institutions like UK now—the one that's the most off-base," says Bieber, "is the stereotype of the indolent tenured professor, who 'has it made' and so has no further interest in research or publishing." Bieber, whose area of expertise is faculty research as it relates to tenure and promotion, explains that at research universities like UK 80 percent of faculty have published at least one article in the last two years.

"Now I suppose to some people this wouldn't seem very productive," Bieber says. "But it says to me that if UK is typical of research universities in the U.S., 80 percent of faculty here are actively working in their discipline, contributing to the production of knowledge" [see article titled "Research: The Magnitude of the Mandate," p. 14]. Bieber adds that of the 20 percent who haven't published in the last two years, a large percentage have been reading and keeping up in their field, remaining "scholarly alert." And in this group, there are some who will have published three or four articles, or a book



Jeffery Bieber and graduate student Susan Burress discuss a graph of nationwide faculty research productivity. Burress expects to receive her master's degree in higher education in the fall of 1993.

perhaps, "the next time you ask the question."

"In my experience, the most unfounded stereotype," says Reedy, "is the researcher hidden away in a library carrel with no desire to interact with the rest of the world. He's working on some esoteric project only to please himself, something that serves no other purpose. That, I think, is the perception farthest from the truth." Reedy points out that research at UK, as in any research university, rarely occurs in isolation. Researchers work with one another and with students—graduates and undergraduates—to solve problems.

"Most of our faculty are here at the university rather than at research institutes because they have an interest in teaching and in students—it's as simple as that," says Jim Boling, associate dean of research in the College of Agriculture. Boling, who places teach-

Full-time faculty members are found to work 50 to 65 hours a week, with approximately half of their time devoted to instructional activities—preparing for classes, grading papers and administering tests.

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TABLE 1

***From the 1990-91 University of Kentucky
Self-Study Undergraduate Survey***

How do students feel about UK as an institution and about their undergraduate education in general? Here is a sampling from the Undergraduate Survey (the categories "strongly agree" and "somewhat agree" are combined here).

	AGREE
The academic environment of the University is conducive to my intellectual growth.	91
Overall, I am satisfied with the quality of teaching at UK.	80
There are professors at UK who take a personal interest in my academic progress.	88
There are professors at UK who have had a great influence on my academic career.	78
Most of my professors encourage students to participate actively in classroom discussion.	86
Professors encourage students to discuss their feelings about important issues.	73
On the whole, I trust the faculty here to look out for students' interests.	75

ing at the heart of scholarly endeavor, clearly sides with physicist Robert Oppenheimer, who said in a lecture at the 200th anniversary of Columbia University in 1954: "It is the proper role of the scientist that he not merely find the truth and communicate it to his fellows, but that he teach, that he try to bring the most honest and most intelligible account of new knowledge to all who will try to learn."

Studies on the Relationship between Research and Teaching

It's not difficult to find a great deal of anecdotal evidence and personal testimony, especially among professors and administrators at research institutions, to support the contention that professors involved in research and in publishing tend to be superior classroom instructors. But such evidence by itself may not convince some people to buy into this relationship.

In his article "Research Productivity and Scholarly Accomplishment of College Teachers as Related to Their Instructional Effectiveness," published in *Research in Higher Education* in 1987, Kenneth Feldman reviews and analyzes the research that has been done since 1950 on the connection between research productivity or scholarly accomplishment of faculty members and their teaching effectiveness. Feldman, a sociologist at the State University of New York, Stonybrook, limits his analysis to projects based upon teaching evaluations by students.

In linking the two variables—research and teaching—Feldman considered several factors from the students' point of view, including classroom attitudes, behaviors, techniques (insofar as these are perceived by students), instructional experience, and the teacher's personality characteristics. In considering research productivity and scholarly accomplishment of faculty members, Feldman considered publication counts, citation counts (the number of times the faculty member's scholarly work has been cited in other publications), success in getting research funds, and ratings by outside



experts in the field. The analysis was restricted to studies of teachers at colleges and universities in the United States and Canada.

The parameters of the studies Feldman examined varied widely. In one study, conducted in 1970, 128 faculty members at the University of Illinois were rated; in a 1973 survey, 349 faculty members at the University of Rochester Colleges of Arts and Sciences, Engineering, and Management were evaluated; and in 1976, 53,034 full-time faculty members at 301 institutions of higher learning were rated.

Overall, 29 studies yielded measurable results in terms of what is called the "Pearson product-moment correlation coefficient," a traditional measurement that is used by social scientists and education researchers to determine the relationship between two variables. Of these 29 studies, 26 showed a positive correlation between research productivity and teaching effectiveness.

All of these studies, of course, are based on students' perceptions of faculty effectiveness. What keeps Feldman's study from being, then, merely a measure of student satisfaction with their teachers, a thinly disguised popularity contest?

"Students' evaluations of teaching are not popularity contests for the most part," says Bieber. "They know good teaching from bad teaching, and students can discriminate regardless of factors that might temper their objectivity, for example, the grades they expect in the course." Bieber adds that in several studies of teacher evaluation, the students are again asked—as alumni—to evaluate their teachers retrospectively, and that ratings of individual teachers are highly consistent with earlier results. "Alumni studies like this," Bieber says, "make Feldman's statistics more solid."

[Table 1 presents some of the results from UK's 1990-91 Self-Study Survey, which focused in part on teaching effectiveness as perceived by students.]

At Ease with the Mission

University of Berkeley vice chancellor John Heilbron terms the teaching/research debate "overblown." He says, "The people who tend to be our distinguished teachers and who are most interested in improving undergraduate education also tend to have distinguished research records. So although it would be idle to deny that some people might slight their teaching to comply with their research imperative, I do not believe that the two enterprises—research and teaching—are antithetical."

"At the research university," Boyer says, "original research and publication should remain the basic expectations and be considered the key criteria by which the performance of most faculty will be assessed. Where else but in our major research universities—with their intellectual and physical resources and their tradition of rigorous and untrammelled inquiry—should the bulk of research in a free society be conducted and rewarded?"

"Perhaps," says Bieber, "research universities like UK—with their unique mission of research, teaching and community service—just need to get more comfortable with their niche, with what it is they do."

Raymond Betts, in a more philosophical tone, says, "A corollary of Socrates' famous dictum, 'The unexamined life is not worth living,' might read, 'The uninformed life is greatly impaired.' To do *research*, to *refresh* our experience, makes our lives richer and more meaningful." ♦

"At a research university, we want to develop students who, rather than just reciting facts that we've given them, can look at a body of knowledge, see what's missing, and focus on what remains to be asked."

—Benjamin Ware,
vice president for research
at Syracuse University

Research: The Magnitude of the Mandate

By Suzanne Froelich



In these lean economic times, research universities are being scrutinized like never before. What is society getting back for the millions of research dollars poured into them each year? Will research universities, like corporations such as General Motors and IBM, have to downsize and streamline amid shrinking budgets and redefined goals?

Here in Kentucky, the recession and a new bill in Frankfort calling for more accountability from state universities have put the University of Kentucky's role as the state's largest research institution into the spotlight. Statements from some politicians suggesting that too much UK research is irrelevant to the average Kentuckian have sparked spirited debates in Frankfort, Lexington and elsewhere about whether UK professors ought to teach more and research less.

These debates raise more questions: How does UK's massive research mission—a record \$69 million effort this year—impact the state? And what would happen if that mission were less intense?

"I think almost every taxpayer would agree that the state would lose a great deal if we did not have a single institution with a broad-based research mission," says Kumble Subbaswamy, associate dean for Advanced Studies in UK's College of Arts and Sciences. "Research is not only the currency with which you teach the latest in any discipline to students; it also is the vehicle that allows us to keep our most talented minds in the state."

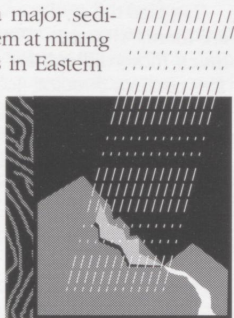


It would be impossible to describe all the major research going on at UK in a single article or a single magazine. Current projects range from studying the formation of black holes in galactic centers to producing fiber-optic catheters that measure lesions in living arteries to developing ways for computers to solve problems with a million unknowns.

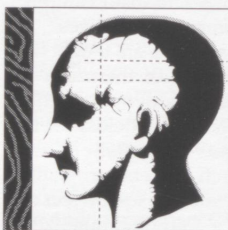
Many other projects are tailor-made to benefit Kentucky. For example:

▲ In response to a major sediment discharge problem at mining and construction sites in Eastern

Kentucky due to the region's hilly topography and heavy rainfall, UK engineers 10 years ago designed a system of controlling this discharge—the largest pollutant in streams and rivers today—that set new state and national standards.



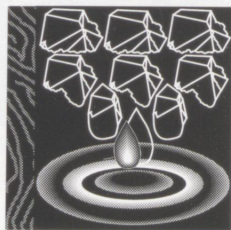
▲ Because Kentucky ranks so high (11th) among the states in strokes, the nation's only state-funded stroke program has been established at UK's Sanders-Brown Center on Aging.



Several thousand stroke patients in the state have benefited from the center's work in research, education and clinical care, says director of the stroke program Robert

Dempsey, a neurosurgeon who has done extensive research on strokes.

▲ Converting coal to liquid fuel has been under study since 1977 by scientists at UK's Center for Applied Energy Research, where more than 300 different types of Kentucky



coal have been analyzed. With the Department of Energy predicting commercial-scale coal liquefaction by the year 2010, this research is laying the groundwork for a new Kentucky industry.

All major universities do research to some extent, but as the state's largest research institution, UK is the only one with a state-wide mandate to discover new knowledge for the benefit of citizens throughout Kentucky. And many educators, farmers, community leaders and others who have benefited in some way from UK research agree that role is vital.

"We do research but we look at it in terms of what it means to our programs," says Charles Kupchella, dean of the Ogden College of Science, Technology and Health at Western Kentucky University. "At UK, work is being done by researchers who have a limited teaching role; there are some people at UK whose only job is to get results in the research lab. Is this good for the state? Absolutely! The state needs answers to questions such as how to best use coal for fuel and how to get more economic punch out of our agricultural base. The people at UK are working on these questions every day."

What would Kentucky be like without a UK? "Look at the former Soviet Union—that is what Kentucky agriculture would be like if it

"Research is not only the currency with which you teach the latest in any discipline to students; it also is the vehicle that allows us to keep our most talented minds in the state."

—Kumble Subbaswamy,
UK associate dean for Advanced Studies

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"What UK offers is exactly what the [former] Soviet Union lacks—good research and development."

—Carlton Earhart, executive director of the Kentucky Soybean Association

were not for UK's experiment station and extension service," says Carlton Earhart, executive director of the Kentucky Soybean Association. "What UK offers is exactly what the [former] Soviet Union lacks—good research and development.

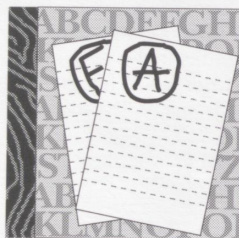
"UK has done excellent research that has helped soybean growers in the state increase yield and lower production costs,"



Earhart says. "And right now UK plant geneticist Glenn Collins is doing some exciting work in gene transfer that may lead to soybeans that are lower

in saturated fat. This could make our commodity much more competitive."

Other work carried out at UK has benefited education in the state. In Lexington last summer, when Henry Clay High School Principal Michael Courtney wanted help in developing a program to reduce the school's 25 percent freshman failure rate, one of those he turned to was UK's Paul DeMesquita, an educational psychologist who has researched teenage behavior. The resulting program has cut the failure rate this year to 14.8 percent.



"Having university research on programs at schools is key to improving education in Kentucky," says Courtney. "Without UK's research element we would not know if what we were doing was successful because we do not have the time or resources to do the research."

In computing—an increasingly important component in all kinds of research—UK is clearly the information and hardware hub for the state. From her desk at the University of Louisville, genetics researcher Kay Phillips regularly taps into the supercomputer at UK to do

her work on a massive national study of twins. Although housed at UK's Center for Computational Sciences, the supercomputer is available to researchers across Kentucky.



"I'm glad the center and the supercomputer are there," she says. "Otherwise, it would be much more difficult for me to do this work. The center's director, John Connolly, is constantly bringing in great people to give high-level computing seminars. He has been a real boon for researchers in Kentucky doing computational-intensive work."

The overall UK research community has grown into a large and complex network of increasingly interconnecting parts. Launched in 1865 as Kentucky's land grant college with 190 students and a mission to do research in agriculture and the "mechanical arts" [see "A Backward Glance: The Emergence of Research Universities in the United States," p. 2], UK today encompasses a 673-acre main campus in Lexington and 14 community colleges.

In Lexington, 23,000 students are taught by 1,566 full-time faculty, most of them active researchers. With so many modern problems calling for answers from diverse fields, UK in recent decades has established 60 multidisciplinary research centers, programs and units. It has nearly 900,000 square feet of laboratory space and a fully computerized library with two million holdings.

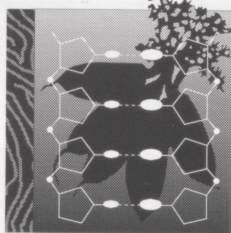
Designated in 1987 as a first-class research university by the Carnegie Foundation—putting UK among the top 50 universities nationwide—the university is particularly strong in medical science, biotechnology, biomedical engineering, computational sciences and agri-



cultural sciences. Two of Kentucky's five Centers of Excellence—research groups recognized by the state for their prominence in a particular area—are at UK: The Sanders-Brown Center on Aging and the Center for Computational Sciences.

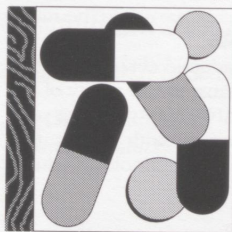
The College of Agriculture alone has more than 300 projects underway involving 250 faculty from 11 departments doing research at the main campus and UK substations or farms in western, northern and eastern Kentucky.

Among the most promising projects is plant pathologist Robert Shepherd's research into tools for gene transfer, a technology that could lead to improved varieties of fruits, vegetables and plants. By learning to regulate genes, it may be possible to produce a plant containing enzymes useful to industry. One example of such practical utility is renin, an enzyme obtained from the stomach of calves that is used to make cheese. Such advances would make cheese production easier and less expensive.



"We cannot know at this stage all the things this work could lead to," says Shepherd, who is the only person in Kentucky to be inducted as a member of the National Academy of Sciences. "But if you do not develop the techniques, you cannot even entertain thoughts about what they can do."

Another area of particular promise at UK is the multidisciplinary Center for Pharmaceutical Science and Technology—the only university-based unit in the country with the capability to discover, develop, manufacture and test new



drugs at one site. Plans are being finalized for construction of an FDA-approved pilot pharmaceutical manufacturing facility with accompanying research laboratories at UK's Coldstream Research Park, where new drugs will be produced for testing.

This integrated approach to drug development and testing has paid off. In 1982, for example, UK immunologist John S. Thompson cloned a unique monoclonal anti-

body designed to combat rejection complications in kidney transplant patients. He took it to the center, where it was developed into liquid- and freeze-dried dosage forms and manufactured for clinical trials. The monoclonal antibody is presently being tested at the University Hospital with promising results. Negotiations are underway to transfer this technology to a pharmaceutical company which will complete requirements for FDA approval prior to marketing.

"We are hoping the center, with its nucleus of pharmaceutical expertise, will be a magnet to bring pharmaceutical industry to Kentucky," says Foster, noting that the state now has none.

"Consider our economic competitiveness with Japan; this problem involves industrial technology, education, linguistics, economics, sociology. Solving such issues can no longer be accomplished through a single discipline."

—Robert Atwell, president of the American Council on Education

Research in low-tech areas sometimes gets eclipsed by the high-tech breakthroughs, but its impact can be just as powerful, as evidenced by UK's multidisciplinary Appalachian Center.

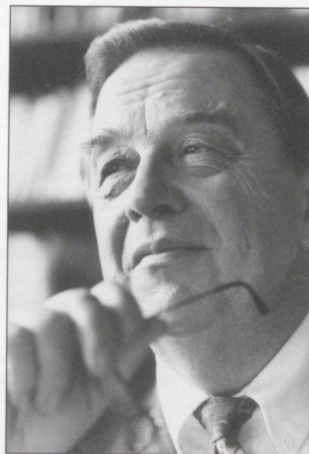
As part of the center's Appalachian Civic

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Leadership Project, researcher/writer William Keesler compared official unemployment figures with workforce data based on population statistics and came up with jobless rates far higher than official state figures for the region. These findings sparked statewide newspaper articles about unemployment rates and a congressional proposal that Congress reevaluate how jobless statistics are gathered.

The project, with hundreds of participants in 49 Eastern Kentucky counties, involves regular community gatherings where residents discuss economic development, health care, the environment and other topics crucial to their communities. The issues and possible solutions are outlined in easy-to-read booklets prepared by the center and based on UK research.

"My major job is to link UK research with the needs that exist in these communities," says Ronald Eller, center director. "There are a dozen other university-related Appalachian centers in the country, but I don't know of any that directly apply research to current issues in the way we do."



Daniel Reedy, dean of UK's Graduate School, has taught Spanish and Latin American Studies for 30 years.

Despite the obvious impact of these and other UK research programs, no one is predicting the '90s will bring another doubling of research funds.

As the national economy settles into what most experts consider a permanent contraction, shrinking budgets are compelling UK and other large research institutions to regroup and reshape themselves.

Nationwide, the trend is toward downsizing and specialization. Columbia University faces deficits that could reach \$87 million by 1993, Stanford University has trimmed its budgets by up to 13 percent, and Yale University plans to eliminate 10.7 percent of its faculty positions and drop linguistics. Washington University in St. Louis has phased out its sociology department and School of Dentistry, and Glassboro State College in New Jersey is eliminating programs in dance, speech, French and industrial technology.

"Large universities can no longer pretend to be all things to all people," says Robert Atwell, president of the American Council on Education. "Some may be strong in sociology and others in law, but not all equally competitive in everything."

At UK, administrators and faculty "will have to make hard decisions in the '90s about what we keep and what we let go," says UK's Graduate School dean Daniel Reedy.

"We were seen as an agricultural and engineering institution until we began expanding in the '50s and '60s," he says. "The last areas to offer doctoral programs were the social sciences, humanities and fine arts. It stands to reason that as we begin to contract, those areas may be the most vulnerable. If they shrink in some ways, they may play a greater role in multidisciplinary research; we are in the midst of a dialogue about this."

Multidisciplinary academic centers are "the wave of the future because of the reality of the world today," says Atwell. "Consider our economic competitiveness with Japan; this problem involves industrial technology, educa-



tion, linguistics, economics, sociology. Solving such issues can no longer be accomplished through a single discipline."

There will be more cross-disciplinary research at UK through established centers and also in new areas, predicts Linda Magid, UK's vice president for Research and Graduate Studies. "For example, we have an informal group of faculty from preventive medicine, nursing, health education and environmental sciences studying health-risk reduction for rural youths. This is the kind of multidisciplinary program we will be looking at in the '90s."

With more crossover of programs and ideas among disciplines, administrative structures also will have to change," says Reedy. "Someone once said university departments and colleges are like so many straight-up-and-down silos. In the future they will be arranged more like a pentagon, where you move horizontally. And UK has a good record of horizontal movement."

During the '90s, large research universities may get leaner and more creative about how they use their resources, but their basic mission remains "terribly important," says Atwell.

"The term 'research university' as opposed to 'university' implies that discovering new knowledge is part of that institution's purpose—and that is a defensible proposition," he says. "Look

"As a taxpayer and a citizen, I realize we cannot have a healthy state economy without a significant scientific and research base..."

—Charles Kupchella,
Western Kentucky University



Linda Magid was appointed vice president for Research and Graduate Studies in July of 1991.

continue to do that."

If UK had a less ambitious research mission, chances are plant pathologist Robert Shepherd still would have developed new gene transfer technology for plants, immunologist John Thompson would have discovered a monoclonal antibody for kidney transplant patients, and historian Ronald Eller would have devised ways to link academic research to community needs.

But none of it would have happened in Kentucky.

UK's contributions to the state are acknowledged even by those who compete with the university for state funds in Frankfort. "As a taxpayer and a citizen, I realize we cannot have a healthy state economy without a significant scientific and research base," says Western Kentucky University's Kupchella. "And the state depends on UK to provide much of that base.

"If it were not here, we would be sacrificing our future." ♦

But Can They Teach?



UK Students Assess Researchers in the Classroom

By Suzanne Froelich

Will University of Kentucky junior Kevin Thomas find a cure for cancer this semester?

Probably not. But as a lab assistant to UK's Ramesh Gupta, a nationally respected researcher who appeared on the cover of *Cancer Research* magazine last year, Thomas is more deeply involved in the research world than he ever dreamed he'd be as an undergraduate.

"I got lucky," says Thomas, a chemistry/biology major who for the past two years has been working, under Gupta's guidance, with DNA extracted from broccoli to see if certain spots on the DNA could be used to slow down cancer in humans. "It is his project, but I get to do some of the work. I am learning more about science in his lab than I probably ever would in a classroom."

Such student-researcher collaborations are not unusual at UK, where many professors have national or international reputations for their research. While not all students are hands-on assistants like Thomas, many agree that being taught by professors who are actively expanding the boundaries of knowledge makes education jump off the page and come alive.

"Professors who are researchers are more gung-ho and motivated about their field," says Trey LaCharite, a UK graduate student in the biological sciences Ph.D. program. "I can think of several professors I've had who, because they did research, could present in class data they themselves had generated. It was like getting it from the horse's mouth—it was exciting."

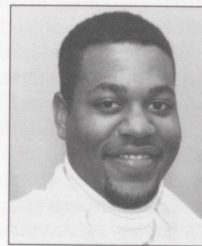
Senior Charles Miday says no archaeology textbook could present as vivid a picture of what it is like to work at a dig as the classroom anecdotes of Professor Thomas Dillahay, who for the past 15 years has been excavating a 13,000-year-old campsite in Chile, among other

projects. Dillahay's work has received world-wide publicity and is reshaping our knowledge of when prehistoric settlers arrived in the New World and how they lived [See article titled "Piecing Together the Past," page 35].

Miday recalls an archaeological methods and theories course in which Dillahay described how, because his Chilean site was in a bog, he had to live in a swamp for two months. "He made me see archaeology is not always as exciting as it seems in the movies. By talking about stone tools he found, the people who live there today, climate conditions and other things, he was able to give us the minute details that make each site unique."

The benefits of being taught by researchers also come across in informal chats, says Logan Whalen, a master's degree student in French who wants to research the medieval period.

"One of my teachers, Rupert Pickens, is researching the Vulgate Cycle, a collection of 13th-century French manuscripts about the King Arthur Legends—he is transcribing them from medieval French calligraphy to Old French type," says Whalen. "My just stopping by his office in the off-hours to talk about



Kevin Thomas

"Of the professors I've had at UK, the most active researchers have been the best teachers."

—Kirby Goidel,
Ph.D. student in
political science

"Professors who are researchers are more gung-ho and motivated about their field."

—Trey LaCharite,
UK graduate student in the biological sciences Ph.D. program

this has been very helpful in showing me what I have to look forward to.

"I am going on for my Ph.D. and I'd stay here if I could," says Whalen, "because I'd like to extend my time under the guidance of a man like Rupert Pickens—specifically because of the research he is doing." (UK does not grant doctorates in French.)

Senior David Croshaw says the practical lessons he learns as a part-time lab assistant to Karl Dawson, one of the premier rumen microbiologists in the country, go beyond what he could get from his textbooks.

"We are working with ruminal bacteria—the kind found in cows' stomachs—and trying to find ways to increase digestive efficiency, which would lead to higher beef and milk yields," says Croshaw, an agricultural biotechnology major. "Is this job advantageous to me? Of course it is—the way to get new and interesting information is through the people doing the research, especially in a research-oriented field like biotechnology."

For Kirby Goidel, a Ph.D. student in political science, UK's special research mission was not a major factor in his choosing to come here. But

now that he has been here for three years, he says it should have been.

"Teachers who just teach might tend to base their class on what they taught last year," he says. "But researchers keep moving forward in terms of knowing what other researchers are doing and thinking up new projects for themselves."

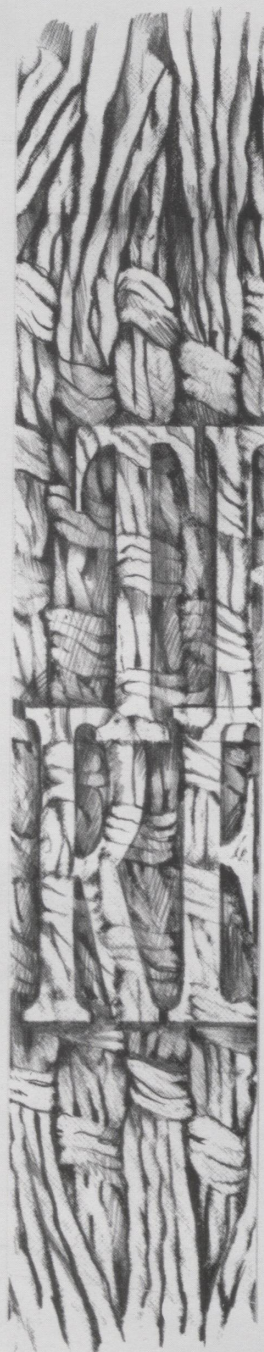
One of Goidel's professors is Malcolm Jewell, a prolific researcher in political science. "Because he has been so active, he can immediately tell students who have a research idea whether it is something they should pursue," says Goidel. "He always has the information—it's amazing. I haven't seen any student stump him yet!"

In one course Goidel had with Jewell, the textbook used (*The Legislative Handbook*) had been edited and partially written by Jewell. Says Goidel: "Obviously he had a lot of insight into the subject matter. In most graduate courses, you read articles written by your professors and it helps.

"Of the professors I've had at UK," Goidel concludes, "the most active researchers have been the best teachers." ♦



Rupert Pickens (left)
with graduate student
Logan Whalen,
a teaching assistant
in the French
department who is
specializing in medieval
French literature



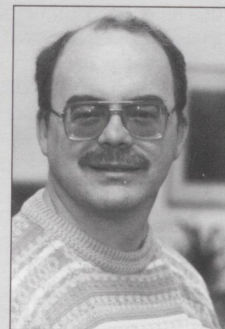
How are we doing?

Editor's Note: We asked several UK faculty members to comment on their research and teaching experiences and their attitudes about these activities. Their comments, edited for space and format requirements, appear below. The participants are Lance DeLong, physics & astronomy; Don Frazier, physiology & biophysics; Charles Hamrin, Jr., chemical engineering; Bernhard Hennig, nutrition & food science; Alan Kaplan, microbiology & immunology; Joseph Kuc, plant pathology; Andy Seybert, mechanical engineering; Ann R. Tickamyer, sociology; and Judith Worell, counseling psychology.

A direct question to get us started: Do researchers tend to be good teachers?

Kaplan: I've observed through the years that, in general, outstanding researchers most often are also very good teachers. The rigor and care required for outstanding research and science translates easily to the organization and clarity of thought that is essential for good teaching.

Seybert: I don't think there's any universal answer to the question, but to associate bad teaching with research is clearly simplistic. Effective teaching is largely a result of self-motivation and a sense of responsibility to the student and the university.



Andy Seybert

Tickamyer: I think it's with undergraduate education that



Ann Tickamyer

the role of research is most misunderstood as it relates to good teaching. The way I look at it, my research allows me to speak with authority and knowledge on the subjects I teach. Stu-

TEACHING RESEARCH

dents respond to this—they simply wouldn't be as enthusiastic if I were merely transmitting received wisdom.

DeLong: The faces in my classroom light up when I talk about my own work, not because it's noticeably better than someone's else's research, but because the excitement of that work is directly accessible to the students.



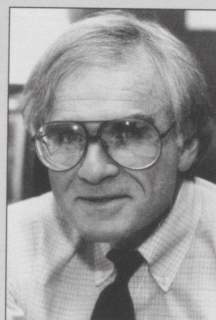
Lance DeLong

Hennig: Yes, I feel the same thing. It's natural for me to go beyond the textbook information so the students get the latest information on, say, a recent nutritional study of atherosclerosis. . .



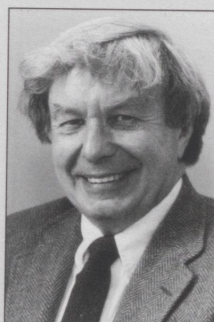
Bernhard Hennig

Kaplan: And there's been such an information explosion that it gets harder and harder to keep up. Molecular biology has increased the rate of new discoveries and new information to the point where it would be impossible for us to make sure students had the latest information if our faculty didn't have active research programs.



Alan Kaplan

Kuc: Research provides me with information and concepts I present in class. It focuses and at the same time expands



Joseph Kuc

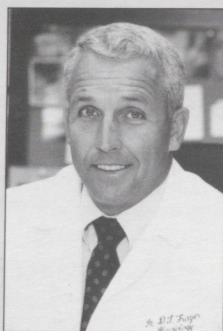
my thinking and therefore, of course, the thinking of my students. I think of research as a chase for knowledge and understanding, and I want to share both with others, whether they are in a classroom, laboratory, farm or home.

Tickamyer: Even as a naive undergraduate at a large state university, it became clear to me that the faculty's engagement with their subject matter was an important part of effective teaching. Bringing a hands-on knowledge and interest in current research distinguished the state university faculty from many of the dedicated teachers in the liberal arts college I'd previously attended.

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Aside from an ability to bring in the most current information, what else do researchers bring to students?

Frazier: I'm convinced that students can discern and appreciate the difference in my enthusiasm when I speak from first-hand experience from my neuroscience research rather than repeat what someone else has written.



Donald Frazier

Kaplan: In my department, two undergraduate courses have been taught for the past nine years—immunobiology and immunobiology laboratory. Both courses are taught by highly regarded researchers and, in part, because of their active involvement in research, they are enthusiastic about immunology, are aware of the latest developments in the rapidly changing field, and are able to convey both their enthusiasm and knowledge to their students.

Hamrin: That's absolutely right—enthusiasm and excitement come directly from research. Nothing I've ever worked on was more exciting than preparing the 90K superconducting material a few years ago. Several faculty were involved, post-docs, graduate students and even an undergraduate student in chemical engineering named David Zint.

I'll never forget getting [then] vice president Royster away from his lawn mower on a Saturday afternoon to show him our superconducting material made with neodymium. You can be sure that excitement carried over into the classroom even though I didn't teach any course that had to do with superconductivity. David [Zint] caught the excitement and prepared many new materials, and was subsequently listed as a co-author on three papers. He also wrote up the work, which led to his being given the Oswald Research and Creativity Award and upon graduating went on to study for an M.S. degree at North Carolina State.

What about the attitudes of researchers toward students, especially undergraduates? Do researchers regard students as "the enemy" since they take time away from research?

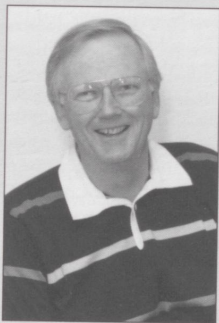
Kuc: That's an incredible misperception. Nothing pleases me more as a professor than to have students ask questions, wanting to learn more about a subject. My office door is always open to students and to everybody in my research group. I want students to do well, and I'm disappointed and, even at times, angry when they don't realize their intellectual potential. A good teacher helps students reach their potential.

Kaplan: There's a widespread but unsubstantiated belief that many faculty, particularly successful researchers, are inaccessible, hard to see. A recent study of this question by Robert Light at Harvard has shown that the overwhelming majority of faculty members, including most senior faculty, are not only easily accessible but invite contact with students. It's been my experience that here at UK

TEACHING RESEARCH

faculty at all levels, many who are nationally recognized for their research, spend substantial amounts of time trying to get students to take advantage of available opportunities.

Hamrin: And what a lot of people might not realize is that



Charles Hamrin

there's a fair amount of one-on-one teaching that goes on here. This morning, for example, a chemical engineering student named Mr. Lee came to see me to go over some experimental results he'd gotten at CAER [the Center for Applied Energy Research]. He is studying the catalytic activity of nitrides, and one of the catalysts is giving odd results: it's yielding different products as the flow rate changes.

We sat down together, I looked at his work and suggested a couple of references for him to check, and I'll go back to the books myself to see if anyone else has handled a similar situation. Well, this is the heart of research: one-on-one teaching which is unsurpassed "quality time" for student and teacher.

Worell:

One of the joys of being both a researcher and a professor in a graduate program is the opportunity to work with students in situations where we are all teachers and learners. My research is stimulated by students' comments in class, in research seminars and in informal discussions. One of my research focuses right now involves looking at how women and men communicate, interact and support one another in close interpersonal relationships. In both field studies and in the classroom, the graduate students I work with help me try to answer some very tough questions about human behavior.



Judith Worell

goal should be to provide a meaningful learning environment for students—one that broadens their understanding of the forces that shape the world and equips them to succeed in dealing with these forces. This can't happen if faculty have no role in knowledge production.

Kuc: Without research there would be nothing to teach. This is equally true for science and humanities.

Frazier: Research and teaching are never at odds. Learning, teaching and research—at the University of Kentucky—are inextricably entwined and nurture, support and reinforce each other. ♦

What would you say to those who believe that teaching and research are conflicting activities?

Tickamyer: I think research is not conducted at the expense of teaching at all; it's an integral part of it. The university's

HONORABLE MENTION

There it was, filling the entire page. An immense swirling crimson ball with several of its 14 moons fixed in their syncopated orbits: Jupiter.

"This was in an astronomy book my older sister gave me when I was about 10," says W. Reid Thompson, a Kentucky native who graduated from UK with a B.S. degree in chemistry in 1973. "It was all about galaxies, stars and planets, which we knew very little about at the time. I was totally fascinated."

Thompson, almost exactly 30 years from the day he first paged through this gift from his sister, has seen and participated in real planetary exploration—starting with the Voyager flybys of Uranus and Neptune. And as a senior research associate in astronomy and space sciences at Cornell University, he is now playing a major role in the \$1.5 billion Galileo project, whose mission is to begin orbiting Jupiter in December of 1995, relaying information about the solar system's largest planet. "The goal is to orbit Jupiter for about two years, to study the moons, the planet itself, and to drop a probe into the atmosphere," says Thompson, whose specialty is the composition

UK Graduate Puts a New Face on Mother Earth

by Jeff Worley

and chemistry of planetary materials.

Galileo is headed to Jupiter, but it is taking the long way there, he explains. After being launched from the space-shuttle Atlantis in October of 1989, Galileo flew close to Venus, then came back by Earth in December of 1990. It used the gravitational pull of each planet as a slingshot to pick up speed before veering off into space again. Galileo sped away from Earth but returned a second time, in December of 1992, and on its most recent re-encounter left something behind.

"These fly-by trajectories started us thinking," Thompson says. "Since Galileo would be so close to Earth, why not pop the covers off some of the really superb instruments on board and activate them—take some photos of the Earth from this vantage point?" After much

discussion ("This idea wasn't enthusiastically applauded by everyone"), this is exactly what the scientists did.

Galileo flew to within 600 miles of Earth, then began taking photos as it sped away. By the time the spacecraft was 1.2 million miles away, it could capture the entire planet in each frame. The images—with Antarctica at the bottom of each—were of the southern Hemisphere and were extremely bright.

Using map projection software developed at Cornell, Thompson fed the digital data into a computer, creating

a photo with Antarctica in the center. Through the process of "imagemosaicking," he was able to include parts of South America, Africa and Australia. The computer also changed the lighting, to show how the continent would look if the sun were shining directly overhead. In addition to the



W. Reid Thompson, with a model of the Voyager spacecraft

unique perspective, this was the first time a spacecraft constructed images of almost the entire surface of the planet in a single day.

Then Thompson used the six wavelengths, or "bands," available to Galileo to produce special pictures where the color represents the presence of, and subtle differences in, vegetation, snow and ice, and water vapor. "With this color strategy you can, for example, readily tell the difference between the grasslands in Argentina and the rain forests in Brazil," says Thompson.

The computer techniques he used to produce the photographs could be useful in monitoring the earth's environment with remote-sensing spacecraft. "We could monitor effects of human activity and climatic fluctuations, such as the extent of ice caps and glaciers, distribution of various types of vegetation, destruction of rain forest, growth of deserts, and so on."

This was the first time a spacecraft constructed images of almost the entire surface of the planet in a single day.

Thompson, whose academic honors include the Clark Award for Distinguished Teaching at Cornell, looks back at his UK days with "a lot of fondness and gratitude," recalling several professors who left their mark.

"I remember Bill Plunket, who taught physical chemistry, very well. He was relaxed and very charismatic, and it's always easier to learn from someone who can make you feel comfortable. We appreciated his genuineness and his ability.

"Then there was

Professor Sabharwal. He taught biology for majors and, believe me, was one of the snappiest dressers on campus. He was the only guy I've ever seen who wore color-coordinated suits and turbans. His lectures were always well organized, and he knew how to use humor in an effective way. Once or twice in every class he would toss in a joke or mispronounce scientific names—always on purpose—to encourage us to pay close attention. Which we did."

Thompson also mentions the importance of the "even-handed advice" he got from a number of professors when he began thinking about graduate school. "Bill Ehmann, Donald Sands and Paul Corio all gave me good advice about which schools to apply to, which government grants to try for, and I just wouldn't have known how to go about any of that without some direction." One result of this mentoring was a National Science Foundation Fellowship, which Thompson held from 1973 to 1976.

Thompson's research through the years has resulted in nearly 50 presentations and abstracts and over 30 published articles, a number of these co-authored by a "C. Sagan."

"Carl's office is just down the hall, and he's a pleasant guy, very easy to talk to," Thompson says. "And I've never met anyone who's so joyous about discovery—Carl has been able to keep alive a kind of childlike fascination with science."

With so much going right these days for Thompson, are there any disappointments?

"The only frustrating thing about this work is the non-committal approach the government has toward funding plan-

"Carl's [Sagan] office is just down the hall, and he's a pleasant guy, very easy to talk to. And I've never met anyone who's so joyous about discovery—Carl has been able to keep alive a kind of childlike fascination with science."

etary exploration," Thompson says. "It's always a small part of the budget and every year you're in danger of being cancelled. Space exploration is a fascinating testimony to the outreach of the human species. Our understanding of both other planets and our own is being built, step by step, largely as a result of the efforts of these robotic explorers that project our presence into other worlds."♦

KIOSK

Past Progress and Future Promise

In 1982 when ODYSSEY premiered, faculty received awards of \$31.2 million for research, teaching and public service projects. By 1991—the past fiscal year—the awards had more than doubled—to \$67.1 million.

Increased awards are one indicator of faculty effort and progress, but the important question is, What has been gained from those dollars? There are examples of those direct benefits throughout this issue of ODYSSEY as there have been in every issue—benefits to Kentuckians and often to those far beyond our state as well.

As we note a decade of publishing ODYSSEY, it seems appropriate to look at a few of the research efforts that have had substantial impact in the past 10 years and then look ahead at several projects that are just beginning and that appear to have great future promise.

PAST PROGRESS

“Kentucky Pipe” Dream

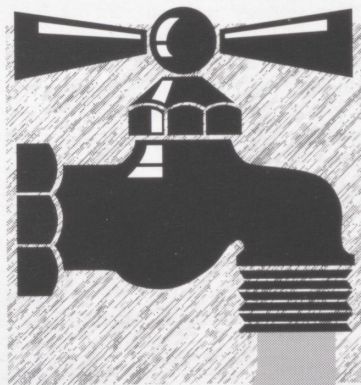
When you turn on your kitchen faucet, you assume clean water will gush out. When firefighters open a hydrant, having enough water at the right pressure is a life-or-death situation. And when city planners approve a new shopping mall, they count on their municipal water system's capacity to expand.

The world's most widely used computer model for assessing and designing water distribution systems is called “Kentucky Pipe” and was developed by University of Kentucky civil engineer Don J. Wood.

More than 10,000 of these models have been sold through UK's Civil Engineering Software Center to consulting engineers and municipalities in the U.S. and 30 foreign countries. An estimated 1,000 U.S. cities and towns, including Lexington and Louisville, have modeled their water systems using Kentucky Pipe.

“We get about 20 calls a day from people using this model or wanting it,” says Wood. “This is mostly from word of mouth; we do not advertise.”

Kentucky Pipe was first developed and offered to the public in 1974, but has been improved by research over the past 10 years to produce new modeling capabilities that should result in millions of dollars of savings as



pipe infrastructure is upgraded and replaced over the coming

years.

“While the biggest users are municipalities and rural water systems, this program can be applied to any piping system that transports liq-

uids," says Wood. "It is currently used by oil refineries and for heating and air-conditioning systems."

Kentucky Pipe has focused worldwide attention on UK and given Wood the satisfaction of seeing his research benefit society on a wide scale. "It is uncommon that we get to work on something we see people using so quickly," he says. "That aspect of it has given me great pleasure."

This research, he adds, illustrates "the essence of civil engineering—applying physics and math to model a complex real system and using this model to make predictions as to how the system will behave."

Filtering Out the Fat

Development of an in-vitro cell culture model system by UK nutrition and food science professor Bernhard Hennig has provided an important new tool in studying cardiovascular disease, the No. 1 cause of death in this country.

"Our blood vessels are lined with endothelial cells that are like a sieve," says Hennig. "If the barrier function of these cells is disrupted, cholesterol-carrying molecules in the blood are able to get into the vessel wall and form fatty deposits."

The in-vitro cell culture model system includes a filter on which scientists can grow cells and observe movement of molecules, says Hennig, who has received international attention for being one of the first researchers to use such a model to study nutrition and heart disease.

"With this system, you can study the barrier function of these cells as you expose them to certain things that are believed to contribute to

heart disease, such as cholesterol, certain fatty acids and nicotine," he says. "You also can study the effects of things thought to strengthen your protection against heart disease, such as vitamin E and zinc."

"By studying how various nutrients affect the barrier capacity of endothelial cells, we come to a greater understanding of the cardiovascular disease process, and of possible dietary treatments."

Alzheimer's Research Leads to Clues in SIDS Deaths

A baby's death is one of the most painful tragedies a family can face. But when the death is unexplained, as is the case with the 5,000 babies who die from Sudden Infant Death Syndrome (SIDS) each year, the pain is often overwhelming.

Research by UK neuroscientist D. Larry Sparks and UK forensic pathologist John Hunsaker has uncovered some important clues in understanding SIDS and hopefully will lead to new knowledge about avoiding SIDS deaths in the future.

"We may have found what causes SIDS in our most recent study," says Sparks. "We found degeneration of neurons in the area of the brain that controls involuntary respiration. We found this by using

antibodies and techniques I had used earlier in Alzheimer's disease research and adapted to SIDS babies."

Sparks and Hunsaker, who received international publicity on this discovery when it was published in *The Journal of Child Neurology* last year, have collaborated on several studies and published three papers since beginning their SIDS research six years ago. They have two more papers in the works.

In earlier studies, they found that the brain's pineal gland, important in sleep and temperature regulation, was smaller in SIDS babies, and that the chemistry of the hypothalamus, another region of the brain involved in sleep regulation, is altered.

Sparks says these discoveries suggest at-risk infants in the future could be identified through magnetic resonance imaging photos of their brains. The next step is to do larger studies with at least 50 SIDS babies and an equally large control group, says Sparks. SIDS has also been studied by other researchers,

but the key to the breakthroughs at UK was Sparks' transferring the antibodies and techniques he developed in the Alzheimer's work to SIDS babies. "That crossover was very fruitful," he says.



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Dental Treatments Aid Cancer Patients

For bone marrow patients and cancer patients receiving head and neck radiation or high-dose chemotherapy, oral infections can be a fatal complication. But a research group in UK's College of Dentistry has pioneered the use of an oral anti-microbial agent that has become the standard of care in combatting these infections.

By using chlorhexidine, a mouthwash commonly used to treat gingivitis, with these patients, the researchers dramatically reduced oral complications, says Gerald A. Ferretti, a professor of pediatric dentistry and pediatrics, and one of the researchers on the project.

"There was significantly less oral infection, healing was faster, and where there were ulcerations, they were not as intense," he says. Other benefits for patients included being better able to eat, using less morphine for pain, and shorter hospital stays.

Since the group, which also includes clinician Ted Raybould and microbiologists Albert Brown and Thomas Lillich, published its findings in 1987, chlorhexidine "has become a standard of care in supportive care measures during intensive cancer therapy in the United States," says Ferretti.

Pioneers in No-Plow Planting

A 20-year research effort at UK's College of Agriculture has led to a no-tillage system of planting crops that is

not only quicker and easier than the traditional plowing method, but is saving farmers in this and other countries billions of dollars and millions of tons of topsoil.

The system, developed from research started by retired UK agronomist Shirley Phillips in the late 1960s, involves planting crops in killed grass or cover crops, which serve as a sort of mulch, instead of planting in tilled soil. This cover protects the soil from erosion, reduces rainwater evaporation so soil can better withstand short draughts, and saves fuel costs since no disks or plows are used.

"No-tillage works best with corn, soybeans and wheat," says soil chemist Grant Thomas, one of several UK scientists who have worked on this system. "Also some promising research has been done on no-tillage tobacco."

Today no-tillage methods are used in all the states—and used extensively in half the states, says Thomas. In Kentucky, 85 percent of double-crop soybeans (soybeans planted immediately after wheat) are planted this way, as is 29 percent of corn, 22 percent of full-season soybeans and 20 percent of wheat.



All told, 20 million acres of U.S. farmland last year were covered with no-tillage crops, and there will be more this year, says Thomas.

In South and Central America, where crops and climatic conditions are similar to this country's, no-tillage planting is also taking hold. Thomas, Phillips and other UK scientists have made trips to Argentina to talk to farmers about the system. Millions of acres are already planted this way in Argentina, Chile, Brazil, Mexico and other Latin countries, says Thomas.

Land-grant universities in Ohio, Maryland and Virginia also have done no-tillage research, but UK has been the leader, says Jim Boling, associate director of the Agricultural Experiment Station. "The uniqueness of our work is that we stuck with it the longest and gained the broadest understanding of no-tillage science and practice. This work has had a tremendous impact on other researchers and on farming practice."

The UK group reported its major findings in the June 1980 issue of *Science* magazine and wrote parts of four books on no-tillage planting. Other members of the group are soil physicist Ronald Phillips, land management expert Robert Blevins, weed scientist William Witt and soil fertility experts Wilbur Fry, Kenneth Wells and John Grove.

"No-tillage is growing faster every year," says Thomas. "Now that the federal government mandates soil conservation systems, I predict it will become the predominant system for growing grain crops in this country."

FUTURE PROMISE

Longer Viability for Transplant Organs

The UK Chandler Medical Center is taking the lead in research to extend the viability of multiple organs used for transplantation. In recent work, Sufan Chien, assistant professor of cardiovascular and thoracic surgery in the College of Medicine, collaborating with Peter Oeltgen, associate professor of pathology, has extended the longevity of animal organs up to 60 hours by using a delta opiate, or "hibernation induction trigger," to keep the organs functioning outside the body. Typically, hearts and lungs removed from the body remain viable for transplantation for only four to six hours, limiting and complicating the surgery.

"In our work we are now using dogs for this research. Their internal system is anatomically close to that of humans," Chien says. He has developed a procedure in which blood vessels remain connected, and the heart, lungs, liver, pancreas, duodenum and kidneys continue to function throughout the procedure. "Blood flow and oxygen delivery continue during this procedure so that tissue damage is minimal,"

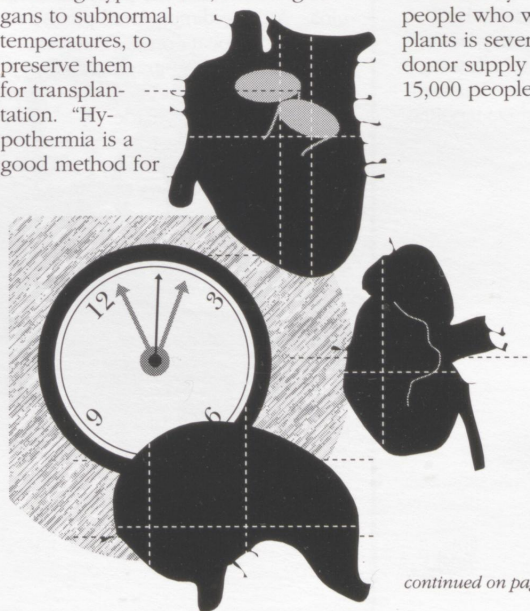
Chien says, "but the operation must be performed very carefully."

Other research teams in the United States, conducting similar research, extract only the heart and lungs, but Chien's procedure has resulted in a higher success rate for much longer periods of time. To Chien's knowledge, the longest "organ viability time" achieved at another American university was 32 hours, attained by a team of researchers in North Carolina.

Many clinical and research teams are using hypothermia, reducing organs to subnormal temperatures, to preserve them for transplantation. "Hypothermia is a good method for

short-time organ preservation and storage, but our objective is long-term preservation," Chien says, "which can be measured in days or longer. Preservation of vital organs for an extended period of time is extremely important because there are no alternative methods of support," he adds. "Improved methods of organ preservation would increase the supply of donor organs and help ensure the quality and survivability of transplanted organs."

Chien says that the number of people who will have heart transplants is severely limited because of donor supply and that as many as 15,000 people who could have



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benefited from a heart transplant die each year. Due to age and a variety of other selection criteria, only 400 to 1,100 viable donor hearts are available each year. The criteria for lung donors are stricter—only 10 to 15 percent of viable heart donors are also potential lung donors.

"Long-term organ preservation will also change surgical transplantation procedures," says Chien. "More time will be available for tissue typing, which is time consuming, and it will be possible to take transplant organs over longer distances to recipients."

John Diana, a professor of physiology and biophysics who has collaborated with Chien, believes that Chien's research is playing a significant role in the age of the multi-organ transplant. "We have great hopes for Chien's research. Someday we may be able to maintain human organ banks within major hospitals, eradicating the emergency nature of such procedures and allowing time for exhaustive tissue matching."

Listening for Tumors

Here are the grim statistics. In 1992, it is estimated that 21,000 new cases of ovarian cancer will be diagnosed in the United States and that 13,000 women will die of the disease. Since early ovarian cancer produces no symptoms, more than two-thirds of patients are initially seen with advanced disease in which five-year survival rates are only 15 to 20 percent.

Researchers at the University of Kentucky are working to rewrite these statistics. John van Nagell, in the Department of Obstetrics and Gynecology, has developed a new technique, called transvaginal sonography (TVS), to detect tumors before any symptoms are present. TVS, van Nagell says, has been shown to be safe, well accepted by patients, and easy to perform.

Here's how it works. A technician inserts a transducer, which emits sound waves, into the patient's vagina. A three-dimensional picture of the ovary appears on a TV screen, and from the photographic images accurate measurements of the ovary (or ovaries) can be made.

In a TVS study conducted from November 1987 to January 1991 at the UK Medical Center, 1300 postmenopausal women underwent screening. To be eligible for the study, women had to be asymptomatic with no known history of a pelvic tumor. Patients with a history of ovarian cancer or prior pelvic radiation were excluded from evaluation.

"Two patients among this group were found to have primary ovarian cancer," van Nagell says, "which would probably not have been detected by other means." One patient, a 50-year-old asymptomatic woman, underwent chemotherapy, and 11 months later no evidence of a tumor was found. The patient is alive and well 24 months after therapy. The second patient is a 72-year-old asymptomatic woman who underwent a hysterectomy for benign disease in 1964. She was diagnosed with an ovarian tumor, which was surgically removed. "The patient is well and with no evidence of recurrence 20 months after therapy," van Nagell says.

He adds that in conjunction with screenings, basic research is being carried on to try to determine what genes are involved in the genesis of ovarian cancer. "We're really in the infancy of this work," van Nagell says.

He would like to see sonograms become adopted nationally, as a routine practice to detect ovarian cancer. In his work, conducted with other UK researchers in the departments of obstetrics and gynecology and pathology, and in conjunction with researchers at Kings College in London, England, van Nagell can point to 10 cases—10 women with ovarian cancer detected in its earliest stage—who have been cured.

"That makes all of us feel pretty good about this work," he says.

Making Pregnancy Safer

Ask Hazel Forsythe what results she would like her current research project to bring about when the new millenium rolls around, and she won't hesitate to tell you:

"Number 1, I would like to see at least 90 percent of pregnant women seek appropriate prenatal care and be given a nutritional risk assessment early in their pregnancy.

"Number 2, I would like to see at least 80 percent of women leave the hospital within 48 hours after giving birth, and with a lot fewer caesarean sections done.

"And Number 3, I would like to see fewer premature and low birth-weight babies so that health-care spending on intensive care for these infants is reduced from approximately \$20,000 daily."

Pregnancy, says Forsythe, an assistant professor of nutrition and food science, should be a time for special awareness of nutrition. But too many women eat the wrong foods, drink too many soft drinks, and continue to smoke and use drugs. Many women and teenagers try to avoid weight gain during pregnancy and so may develop new risky behaviors such as bulimia, while other women gain too much weight.

Forsythe explains that a nutritionally balanced diet is important. And because some women do not realize the dangers of poor nutrition during pregnancy, they maintain old eating habits. "Many women don't know, for example,

that during pregnancy the body uses glucose in a different way," Forsythe explains, "and that these changes could result in a form of diabetes only seen during pregnancy." Gestational diabetes may be prevented by a steady, balanced supply of nutrients and appropriate weight gain.

In a research project titled "Nutritional Risk Assessment and Prenatal Care," Forsythe is examining food selections and behavior profiles, and their effect on pregnancy outcome with and without a nutritional risk assessment to guide prenatal care. She hopes to complete this project in 1994.

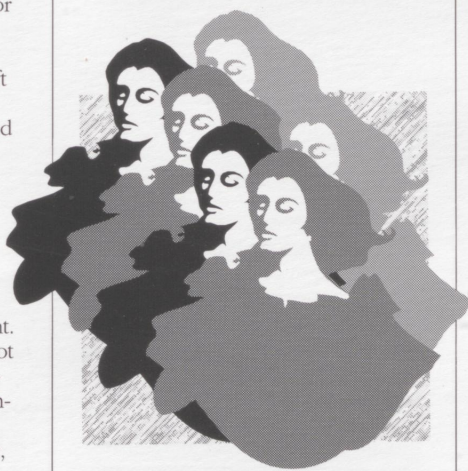
Forsythe explains that the first of four stages of the project involved taking a survey of obstetric and gynecology clinics to collect information on the use of nutritional risk assessment in central and eastern Kentucky. The second (current) stage includes an examination of clinic records of 200 women to compare prenatal care with and without

nutritional risk assessment.

"In the third stage, we plan to develop profiles of food selection and eating behaviors," Forsythe says, "using national nutrition surveys. Information on pregnancy complications from clinic records will help determine the types of nutritional risk most prevalent in Kentucky." Finally, she adds, the researchers want to develop and test a nutritional assessment tool that can be used by anyone in a clinic so that a larger number of women have prenatal care that results in "significantly healthier pregnancies, fully developed babies, and faster recovery time from pregnancy."

Forsythe is working with Margaret Cook-Newell, a registered dietitian and certified diabetes educator, on this project. Delores Smith, a specialist in adolescent health-risk behavior from the University of Tennessee, is a consultant on the project.

Nutritional risk during pregnancy has heightened significance for Kentucky, especially in rural areas. Kentucky falls below the national average in number of



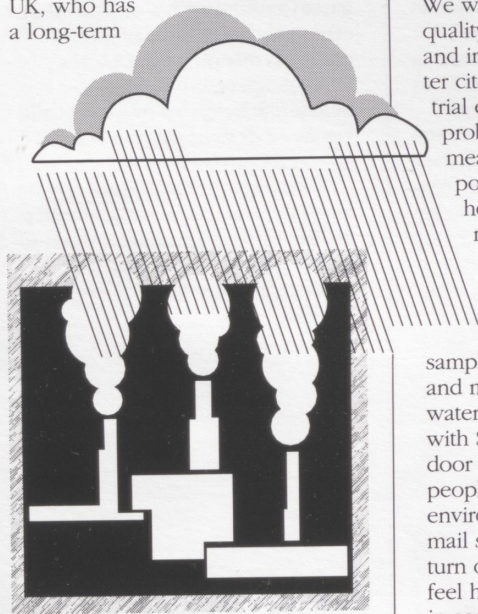
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births receiving adequate prenatal care, births per 1000 to teens, and ranks as the seventh highest in the nation in illness and death relating to pregnancy.

Geographers Assessing Environmental Concerns in Bratislava and Cleveland

Though the winds of political change have been blowing through Eastern Europe, they haven't budged a number of serious environmental problems.

This is the assessment of Stanley Brunn, professor of geography at UK, who has a long-term



research interest in social problems and environmental quality and how these conditions are perceived by people in specific locales. Brunn hopes to travel to Bratislava, the capital of Slovakia in Czechoslovakia, later this year to work with an environmental geographer from the University of Cincinnati. Together, they will try to determine the quality of the environment and the perception of Bratislavians toward their living conditions. They will be working with environmental and social geographers in the Slovak Academy of Sciences.

Why Czechoslovakia?

"For one thing," says Brunn, "it's possible to do this work now that the country is open to researchers. We want to compare environmental quality and perceptions in Bratislava and in Cleveland, since they are sister cities with similar heavy industrial economies and environmental problems. We will take some measurements in both cities of pollution levels and determine how residents perceive environmental risks."

Brunn says that the research plan is twofold: his colleague, Susanna Tong, will take water and soil samples, collect leaves and dust, and measure levels of toxicity in the water and the air. He will conduct, with Slovak geographers, door-to-door surveys to find out how people in the areas studied perceive environmental risk. In Cleveland, a mail survey will be used. "It could turn out," Brunn says, "that people feel highly threatened by pollution in some parts of these cities even though pollution levels aren't that high, or it might be the other way around. We hope to get a 'social di-

mension' of the problems as well as a physical dimension."

This work sounds interesting, but the question might be asked, What does this work have to do with geography?

"Geographers are interested in two primary questions—where and why," says Richard Ulack, chair of the Department of Geography at UK. "Stan and his colleague at UC hope to compare findings in Czechoslovakia with data from the Cleveland area and mix these two 'maps,' a unique undertaking." They will use a geographic information system (GIS) mapping package to prepare "overlay" maps. Ulack adds that other department members have research interests in the changing geographies of East/Central Europe, and that their various projects will include the participation of faculty and students in the European nations involved.

"Given the grave problems—economic, environmental, medical—of Eastern Europe, the research cluster developing here is both timely and very important," Ulack says.

UPDATE

Piecing Together the Past

by Suzanne Froelich

From September to May, Thomas Dillehay is in Lexington teaching, grading freshman papers and helping graduate students shape research projects. In the summers, he toils in remote parts of South America unearthing stone tools and bits of clay that haven't seen daylight in 13,000 years.

Do these two worlds connect?

"Absolutely. They are complementary," says Dillehay, a professor of anthropology who has been fascinated with archaeology since he began collecting Indian arrowheads as an 11-year-old. "My research and my teaching have an enormous impact on each other.

"As a researcher, I can directly give students the results and significance of my projects. Otherwise, I would have to rely on books and articles about others' work—and the lag time between completion of a research project and publication of results can be two to five years."

As a teacher, he has to be up-



Tom Dillehay

to-date on all aspects of anthropology (of which his own specialty, archaeology, is one) because, he says, he teaches broad-based undergraduate courses and fields stimulating questions from "active" students.

ODYSSEY last featured Dillehay

in its premier issue in the spring of 1982. His primary research interest then was the history and lifestyle of the Mapuche Indians, an old but little-studied tribe in Chile he had observed for several summers. Last year, his definitive book on this group, titled *The Araucanos: The Past and Present* ("Araucanos" is what they call themselves) was published in Chile.

An even more significant project this active researcher/teacher has directed during the past 12 years is the excavation of a 13,000-year-old campsite in southern Chile. After the discovery of a large mastodon tooth in Monte Verde in 1976, Dillehay—in Chile teaching at the time—went to survey the area and found signs of an Ice-Age settlement buried under a muddy bog. Over the next seven summers, he headed a team of 35 professionals who dug up wooden implements, chunks of meat, wooden hut foundations, stone tools and scraps of animal hide from an area the size of a football field.

It was slow, tedious, exacting work. "We literally moved everything by millimeters because we had to record and

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chemically preserve everything," says Dillehay. "It was like surgery."

This project suggested that people came to the Americas much earlier and were able to adapt to the environment with more versatility than previously thought. Now recognized as the best archaeological record in the world of wooden hut foundations, wooden implements and ancient animal hides, Dillehay's discoveries have been featured in international journals, *National Geographic*, *Time*, *Readers Digest*, and other national magazines, and on National Geographic's public television show.

Other projects of Dillehay's include excavation of 7,000-year-old garden remains in Northern Peru and a just-begun study of prehistoric flora and fauna at the edge of the Andes in northwest Argentina. "Findings from both projects could tell us how prehistoric inhabitants of these areas lived and handled inter-ethnic conflicts," he says. "When we do archaeology, the objects and architectural styles we find are like a film—frames through time—of different prehistoric groups and how they dealt with one another. What we find adds to our knowledge of human nature in general."

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During the past 10 years, archaeology has become much more specialized, says Dillehay, noting that a large excavation today may involve dozens of non-archaeological experts in such areas as skeletal remains, ceramics, prehistoric soil, wood, soft tissue, ecology, ancient stains and computers.

Computers?

"Access to high-performance computing has dramatically advanced my research in the last four years," he observes. Using UK's supercomputer, Dillehay and his graduate students digitized and stored topographical maps and other site-related data, including acreage and depth statistics and millions of items related to artifacts.

Since 1976, Dillehay has written seven books, including *Volume I: Monte Verde* published by Smithsonian Press. On campus, he served as the director of the Program for Cultural Resource Assessment from 1981-84, as the first director of the Kentucky Anthropological Research Facility from 1984-90, and Dillehay was a member of UK's Research and Graduate Studies Board of Directors from 1981-90. Today he chairs the Dean's Social Sciences Advisory Committee in the College of Arts and Sciences.

Dillehay also has been on 22 doctoral committees and 12 M.A. committees. And he has

served as advisor to a dozen graduate students, several of whom came to UK specifically to work with him. Most of his former students are teaching, with a few doing pure research, he says.

Dillehay admits that his passion for archaeology has changed over time. "After having discovered hundreds of artifacts and opened ground at many different sites, the sense of discovery now is not so great," he says. "Now the meaning is more important: What is the significance of what I am doing? How will it broaden our knowledge? How important is it to society?"

To explain to the general public why studying our distant past is important, Dillehay makes time in his schedule to do interviews with general-interest magazines, write articles for a nationwide anthropology bulletin for teachers, and give some 20 talks a year at high schools, civic centers and universities.

"Archaeology is one of the most popular disciplines and we should take our findings to the public more often, especially since so much of what we do is funded through tax money," he says. "The public has a right to know what we are finding."

Besides, public speaking re-energizes him in the same way teaching active students does. When he gets newcomers to archaeology excited about the field, the feeling flows back to him.

"Last week, I gave a public lecture at the University of Iowa and about 500 people were there. Afterwards, I talked with the audience for about an hour. Many of them—just like a lot of freshmen at the Archaeology 100 level—were enthusiastic to know more. As a teacher, I respond to that. I enjoy it. It's sort of a high." ♦

*Comments about this issue—
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