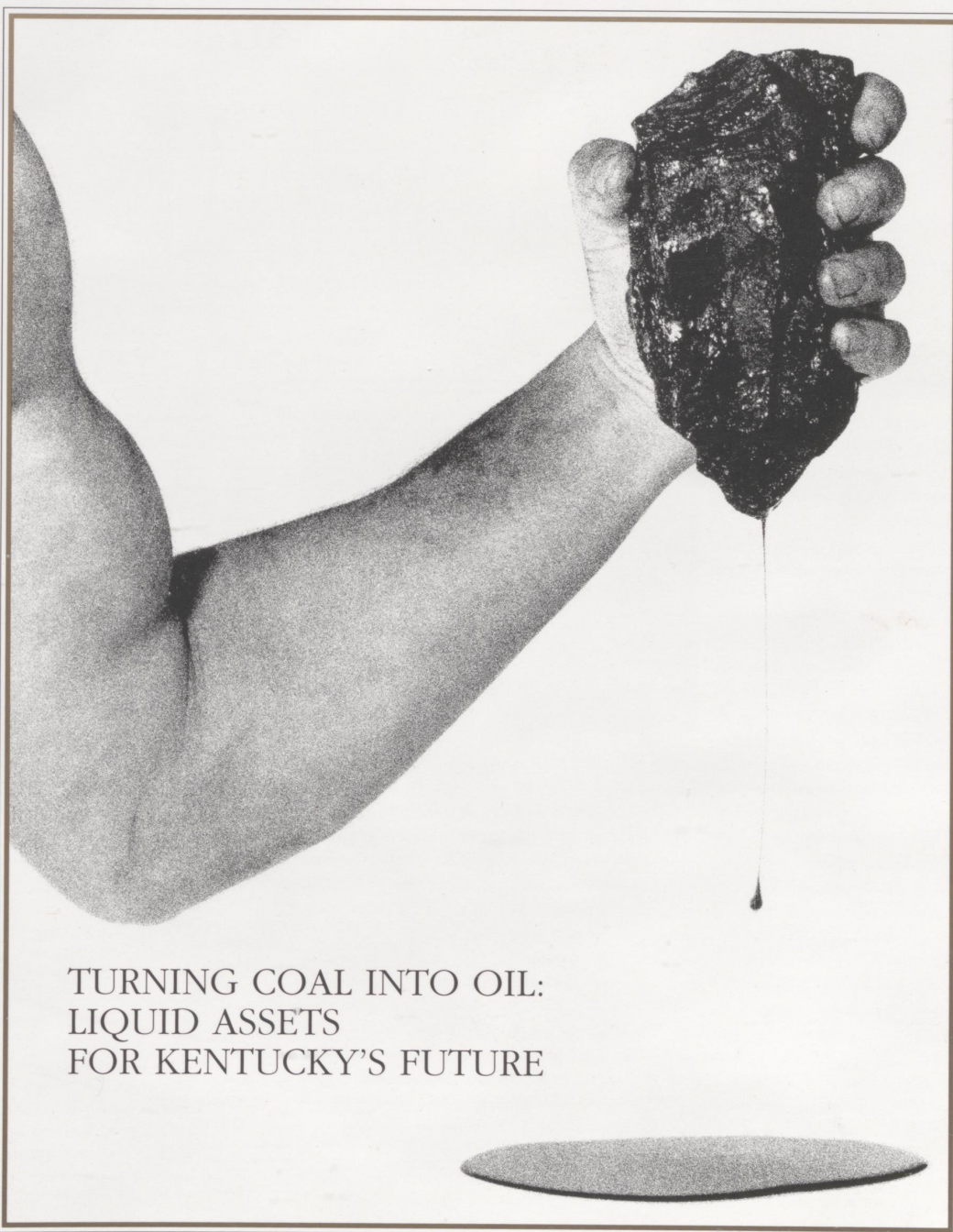


ODYSSEY

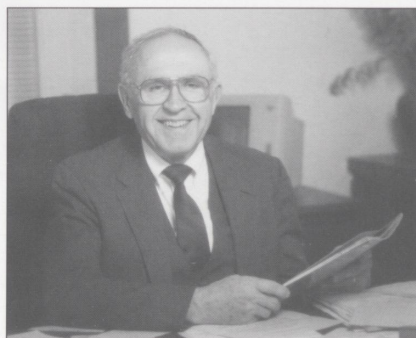
• THE MAGAZINE OF UNIVERSITY OF KENTUCKY RESEARCH • WINTER/SPRING 1990 •



TURNING COAL INTO OIL:
LIQUID ASSETS
FOR KENTUCKY'S FUTURE

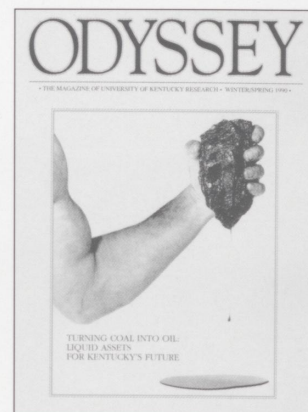
This issue of ODYSSEY is dedicated to Wimberly C. Royster, retiring vice president for Research and Graduate Studies at the University of Kentucky.

Dr. Royster is a mathematician by training and has always viewed himself as a math faculty member temporarily assigned to other activities. Those "temporary" assignments have lasted 27 years and have included such positions as chair of the Department of Mathematics, dean of the College of Arts and Sciences, dean of the Graduate School and vice president for Research and Graduate Studies.



The career of Royster and the emergence of the University of Kentucky as one of the top 45 public research universities in the nation occupy the same space in time. In about a 12-month period in the mid-1940s, Royster arrived on campus as a new graduate student, the Kentucky Research Foundation (later the University of Kentucky Research Foundation) was established, and the Keeneland Foundation gave UK what was most likely its first electron microscope. In a similar 12-month period some 40 years later, UK received almost \$60 million in external grants and contracts through UKRF, the university negotiated the simultaneous purchase of nine electron microscopes, and Royster was named the university's first vice president for Research and Graduate Studies.

Historians have long debated whether "individuals create events" or "events make individuals." In the case of Wimberly Royster and the emergence of research and graduate education at the University of Kentucky, the two are inextricably intertwined. It is with recognition and appreciation of his distinguished career at the University of Kentucky that we dedicate this issue of ODYSSEY to Dr. Royster.



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

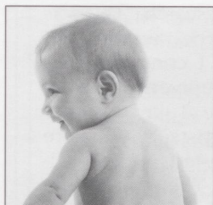
With this mission as its premise, one goal of the university is to conduct programs of basic and applied research which support graduate and professional education, provide for the advancement of knowledge, and seek solutions for the acute problems of society.

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

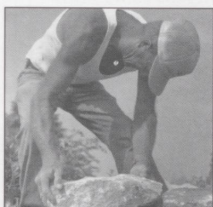
The goal of ODYSSEY is to offer the reader the opportunity to share in some of the excitement, curiosity and creativity evident in the research underway at the University of Kentucky.

ODYSSEY

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by Jeff Worley

It's not quite the transmutational miracle—changing metal to gold—that the alchemists in the Middle Ages had in mind, but it may prove to be the scientific breakthrough that keeps the 21st century in motion.

With the new millenium will come the reality that the world's natural oil supplies will gradually dwindle. But modern researchers in liquefaction science are preparing for that eventuality. At the University of Kentucky, researchers are now at work to discover ways to change coal into liquid fuels.

"We've been doing this work for four years now as part of a five-university consortium," says Gerald Huffman, director of the Consortium for Fossil Fuel Liquefaction Science (CFFLS) and a professor of chemical engineering at UK. Other members of the CFFLS group are Auburn University, the University of Pittsburgh, the University of Utah, and West Virginia University. Also included is the UK Center for Applied Energy Research.

The idea for the consortium came from Lyle Sendlein, currently the director of UK's Institute for Mining & Minerals Research. "I was interested in doing something to increase the research activity in the coal liquefaction area," says Sendlein, also a professor of geological science, "and in the early '80s the federal government just wasn't sponsoring anything new—the Department of Energy budget for synthetic fuels work had plummeted." So Sendlein began talking with DoE Energy officials, who were very encouraging. He then went to Washington, where he met with Senator W. D. Huddleston, who convinced the Senate Appropriations Committee to initiate the funding for liquid

TURNING COAL INTO OIL



Liquid Assets for Kentucky's Future

fuel research. "This was in 1985," Sendlein recalls. I contacted several universities then where I knew other scientists who were interested in liquefaction. The consortium was formed, and with the \$1 million appropriation we were off and running."

The term "liquefaction," Huffman explains, means changing a substance to a liquid form. In the direct liquefaction process, coal is finely ground, mixed with a solvent and hydrogen, and then heated under pressure in hydrogen in metal vats to a high temperature. The hydrogen is assimilated into the molecular structure of the coal, producing a product that can be upgraded for use as a liquid fuel.

Large-scale coal conversion into liquid fuels is not a new idea. Germany used coal-derived liquid fuels regularly during World War II.

When cut off from petroleum supplies by the surrounding Allied forces, the Germans used coal liquids exclusively during the closing months of the war. Present-day South Africa has an extensive coal-to-liquid fuel conversion industry.

"Though both of these processes are different from the conversion techniques we are now exploring," Huffman says, "they proved that coal liquefaction is a viable technology when political and economic conditions warrant it." Long-term commercial development of these fuels will depend on the price of petroleum, Huffman predicted. "When the price of crude reaches \$35 to \$40 a barrel, you will see competitive coal-derived liquid fuels entering the market. I wouldn't be surprised to see this

happen by the year 2010 as petroleum prices rise and our conversion technologies improve."

At the University of Kentucky, Huffman, Naresh Shah, assistant professor of chemical engineering, and Frank Huggins, professor of geological sciences, have been focusing their efforts on the role of catalysts, materials that accelerate chemical reactions, in the liquefaction process. He explains that because the molecules that make up coal are cross-linked, it is necessary to break these links or bonds for the process to work. A catalyst added to the mixture can help to break these bonds. Recently, the researchers have been experimenting with iron-based catalysts.

"The reaction between hydrogen and coal happens because hydrogen reacts with the iron catalyst and is transferred to the bond you want to break," Huffman says. "We're exploring all sorts of ways of adding the iron. The finer the catalyst is, the greater its surface area, of course, which makes for a greater reaction."

“When the price of crude reaches \$35 to \$40 a barrel, you will see competitive coal-derived liquid fuels entering the market.”

Huffman mentions that at the University of Pittsburgh, Irving Wender has been working with liquid compounds called iron carbonyl catalysts. When added to the system, they produce a highly dispersed catalytic reaction. "Wender's results so far," Huffman says, "look to be very promising."

Huffman says that iron may be the ultimate catalyst because it is relatively inexpensive. "You're dealing with large quantities of coal, so you need something cheap enough that

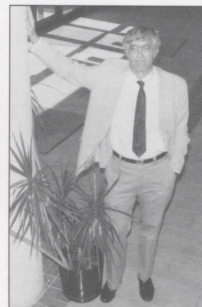
you can essentially throw it away. If you're using nickel or cobalt or molybdenum, some other popular catalysts, you can't just throw them away with the solid residue from the reaction—you have to recover them."

Although none of the liquefaction processes is now economically feasible, Huffman believes that eventually it will be. "The latest estimates I've seen indicate that with current technology you can convert and produce a barrel of oil from coal for about \$38. On the world market right now, oil is going for about \$17-18 a barrel. The objective of course is to keep pushing the liquefaction cost down while the price of oil keeps going up." Huffman's best guess is that "in perhaps 50 to 70 years" it will be economically feasible to sell huge amounts of liquified coal.

Huffman is anything but reticent when he talks about the research capabilities of the consortium. "I think we have the best basic coal research group in the country," he says. "We have outstanding scientists at all five universities, and it's a very integrated program." The consortium members are currently working in four principal research areas related to liquefaction and each member is supplying data for different phases of the research. "This way the work's not duplicated," Huffman says.

In the five universities about 50 faculty and an equal number of graduate students and post-doctoral students participate in the program. "Within the five universities we have just about every sort of capability you could think of in coal science," Huffman says. "There isn't anything one could think of to do in coal liquefaction that we couldn't do somewhere in the consortium."

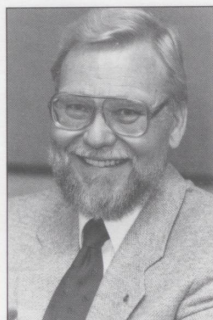
In addition to experiments with iron-based catalysts, a variety of other types of catalysts are being used throughout the consortium. "One that looks pretty promising at the University of Pittsburgh," Huffman says, "is gallium, a metal that becomes a liquid at coal liquefaction temperatures" (400-500 C). Because the metal is a liquid at these temperatures, it is highly dispersed and coats all the



Gerald Huffman

continued on page 4

“The objective of course is to keep pushing the liquefaction cost down while the price of oil keeps going up.”



Lyle Sendlein

iron particles. Cobalt and nickel are being used by other research teams in the consortium, and at Auburn University Christine Curtis and her colleagues have made advances in the use of molybdenum, a metal traditionally used to strengthen and harden steel, as a catalyst in the liquefaction process.

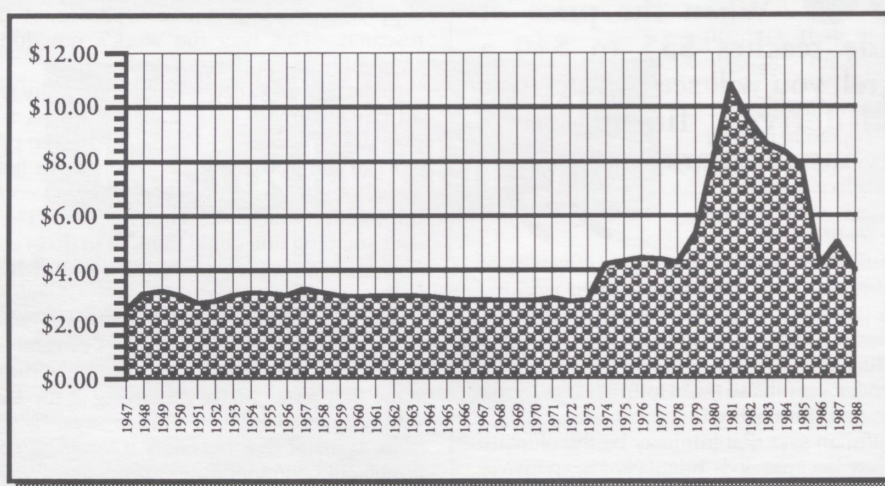
Huffman refers to the third area as “novel liquefaction methods.” “These vary significantly from the traditional liquefaction approach and are being carried out at all five universities,” he explains. At the University of Kentucky, chemical engineers Dibakar Bhattacharyya and Richard Kermode are collaborating with biologist Hussain Aleem to study the biological process of converting coal into liquids. Their efforts are focused on trying to identify bacteria or microbes that at room temperature will attack the coal structure and break its molecular bonds. “The result,”

Huffman says, “might not be a liquid itself but would be a derivative that might be more easily liquefied, a pre-treatment of sorts.”

A fourth area of research in the consortium focuses on understanding the basic structure of coal and relating this structure to the liquefaction process. Different types of coals have different types of structures, so they may behave differently when being processed. Huffman cites as an example the difference in structure between the “lignites,” also called “brown coals,” which are found in the western United States, and bituminous coal, softer coal, mined in the east. “In breaking these coals down, we need to know, for example, how porous they are and what their molecular structure is. Maybe iron will be a better catalyst, or maybe something like molybdenum will be,” he adds.

In the area of basic coal structure characteri-

AVERAGE ANNUAL WELLHEAD PRICE OF UNITED STATES CRUDE OIL IN CURRENT AND CONSTANT 1967 DOLLARS (U.S. DOLLARS PER U.S. BARREL OF 42 GALLONS)



Source:
Current Dollars Price—U.S. Energy Information Administration
Producer Price Index—U.S. Bureau of Labor Statistics
Constant Dollar Price computed by American Petroleum Institute

zation, Huffman says, researchers Ronald Pugmire and Henk Meuzelaar at the University of Utah have made tremendous advances. "I think they have some of the best structural characterization capabilities in the world, and they've made significant progress in understanding the basic molecular structure of coal and the liquids produced from coal." At UK, Kumble Subbaswamy, professor of physics, has been successful in developing quantum mechanical models of coal's molecular structure. His models, developed on the UK supercomputer, are being used to interpret data obtained at the University of Utah and elsewhere in the consortium.

Another goal of the consortium is to collect this structural information and create a data bank. At UK Frank Huggins is in charge of this particular operation. "Slowly but surely," Huffman says, "we've created a pretty solid data base."

"One of the most exciting things for me is just seeing this program come together as it has," Huffman says, "seeing top scientists and professors from five universities working

“There isn't anything one could think of to do in coal liquefaction that we couldn't do somewhere in the consortium.”

together on the same problems." The five-university coal consortium, he believes, is the first of its kind. "It's very fulfilling," adds Sendlein, who has seen his idea blossom. "I feel very good about it."

Last fall the U.S. Department of Energy entered into a \$2.8 million agreement for continuation of the coal liquefaction research program. The consortium members received \$1.4 million, which was matched by the five

member universities. In 1990, DoE requested that the consortium prepare a three-year proposal, a "sole-source solicitation" by the agency. "What DoE is saying, basically, is that this is the only group in the country they'll fund to carry out this research," Huffman explains. "It's a nice bit of recognition."

In April of 1990, the Department of Energy awarded the consortium a \$1.48 million grant to continue liquefaction research. The one-year grant, part of a new three-year agreement between the consortium and the DoE to spend \$9 million on coal liquefaction, began May 1. The new agreement augments the federal funds already granted to UK and the other consortium members.

In addition to this funding, the consortium is attracting a reasonable amount of interest from industry. "We have a lot of industrial representation at our meetings," Huffman says. Most of the major oil companies—Amoco, Exxon, Ashland, and others—have sent representatives to all the consortium meetings. The Electric Power Research Institute and Amoco have contributed funds to the program, money which Huffman says will be used to support travel by faculty and graduate students—"things that aren't covered in the DoE contract."

"By the end of this three-year program," Huffman says, "I'm hopeful we will have reached some conclusions on the best way to turn coal into oil." ♦

David Lazar, senior editor/technical writer for IMMR, contributed to this article.



Graduate students Sudipa Mitra, M. Mehdi Taghiei and Anup Shah are working with UK geologist Frank Huggins to catalogue data resulting from liquefaction experiments at the University of Kentucky. Taghiei is from Iran; Mitra and Shah are from India.



No More Restless Nights: UK Researchers Combating the Dangers of Sleep Apnea

by Elizabeth Hansen

Frank Anderson snored so loudly his family couldn't sleep. As he slept, Anderson, who was in his early 40s and weighed more than 300 pounds, sometimes stopped breathing. After several seconds, the lack of oxygen aroused Anderson enough so that he began breathing again. He drifted back to sleep only to begin the cycle again. His restless nights left Anderson, who was also hypertensive, so sleepy in the daytime that he worried about driving.

Sleep apnea is a pause in breathing that occurs during sleep. The cause of this disease, its effects, and how it is treated are the subjects of several past and ongoing research projects at the University of Kentucky.

Frank Anderson is typical of persons who develop obstructive sleep apnea syndrome, a condition that most often affects overweight, middle-aged males who snore. Excessive tissue or some other physical abnormality blocks or obstructs the airway. This structural abnormality, coupled with an impaired drive to breathe, causes apnea. About four years ago, Anderson lost 56 pounds but quickly gained the weight back and more. "That's when I started snoring," says Anderson, a photographer for the *Lexington Herald-Leader*.

"I didn't use to snore. My wife started complaining that I was snoring a whole lot more and it was becoming very loud, very disruptive. I didn't believe her. She taped me

one night and she played it back to me and I said, 'Well, you ought to take me out and shoot me,'" Anderson recalls. The noise kept both his wife and children awake at night. "Then my wife said one night I woke her up because I just quit breathing. That sort of alarmed me and alarmed her."

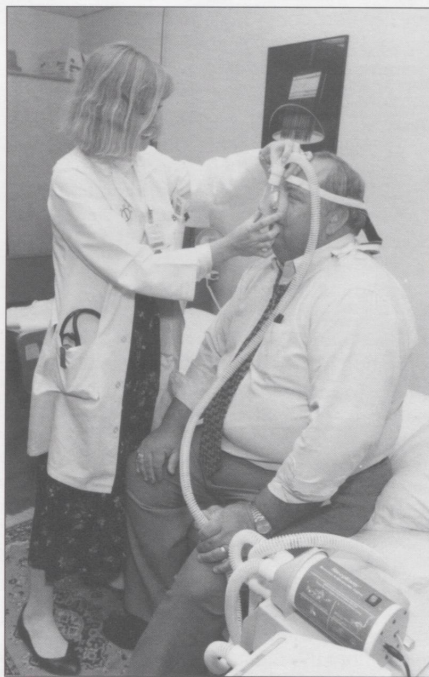
Anderson also noticed that in the afternoons he became so sleepy "I just hardly could hold my head up." His drowsiness made him afraid to drive. He also developed high blood pressure for the first time in his life.

Then one day Anderson heard a radio program about obstructive sleep apnea syndrome. The symptoms described matched his, so he called the University of Kentucky Sleep Disorders Clinic for help. He was evaluated in the sleep lab in the summer of 1988 and became part of a research project conducted by Barbara A. Phillips, associate professor of medicine, that compared two treatments for the syndrome.

Like all adults participating in apnea research projects, Anderson first underwent a nighttime sleep study. He arrived at UK's Chandler Medical Center about 9 p.m. and got ready for bed. The laboratory is two small rooms, one furnished with a hospital bed, television, lamp, a small oriental rug and tables holding medical equipment. An oriental screen hides boxes stored along one wall. A television camera suspended from the ceiling focuses on the bed and sends images to a videotape recorder in an adjacent room where a technician monitors the test subject all night.

Eight to 10 sensors were pasted to Anderson's scalp to measure brainwaves. The wires were laced behind his head into a wire ponytail and then connected to a machine. Other sensors were placed near his eyes to measure eye movement and still others measured muscle activity. A probe he wore near his nose and mouth measured breathing and a clip on an earlobe measured oxygen saturation in the blood. Other sensors monitored heart rate and effort to breathe. All of the wires were connected to a machine that recorded the readings on paper all night. After almost two hours of preparation (none of which is painful or

“My wife started complaining that I was snoring a whole lot more and it was becoming very loud, very disruptive. I didn't believe her.”



Barbara Phillips helps Frank Anderson adjust the mask of a nasal CPAP unit. After sleeping most nights for almost two years with a face mask hooked to the machine, he says he no longer gets tired during the day.

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Apnea in middle-aged people is considered to be significant if there are more than five episodes per sleep hour.



Barbara Phillips

hazardous), Anderson was ready to go to sleep.

A full day of testing followed the sleep test, including a physical exam, a medical history, questionnaires about health, psychological and cognitive abilities tests, pulmonary function tests, motor skills tests and "multiple sleep latency testing." The latter measures how sleepy people are during the daytime by having them lie down for 20-minute naps four times during the day and measuring how quickly they fall asleep, according to David Berry, an assistant professor of psychology who studies sleep apnea. Those who score below a certain threshold—who fall asleep quickly—are considered to be "pathologically sleepy." Subjects also rate how sleepy they feel and describe their sleep habits.

Those tests found that Anderson did indeed suffer from obstructive sleep apnea syndrome.

Apnea in middle-aged people is considered to be significant if there are more than five episodes per sleep hour, according to Yvette R. Cook, assistant professor of neurology, who collaborates with Berry and Phillips on sleep apnea research.

According to Berry, automatic detection devices in the body monitor blood oxygen levels. When an apnea occurs and the oxygen saturation in the bloodstream falls below a set point, the person wakes up or is aroused to a lighter level of sleep and starts breathing again. Carbon dioxide detectors monitor a rise in carbon dioxide and those, too, can stimulate the person to wake up and start breathing again.

People with sleep apnea syndrome have multiple episodes each night. "I'm talking about hundreds of apneas in the worst cases," Berry says. Apneas last from 10 seconds to as long as two minutes, and repeated episodes throughout the night "can be very destructive of the night's sleep," Berry says.

Like Anderson, most people who suffer from sleep apnea have hypersomnolence, or excessive sleepiness, during the day. Hypersomnolence leads to what Phillips terms the most dangerous effect of untreated sleep apnea: car wrecks. Sufferers have three times

as many car wrecks as people who don't have apnea, she says.

Other effects of obstructive sleep apnea in middle-aged people, according to Berry, Phillips and Cook, include cardiac arrhythmias, hypertension, depression, impaired intellectual ability such as reduced attention spans and difficulty in concentrating, irritability, and poor job performance because of drowsiness. Researchers don't know whether impaired intellectual ability in persons with severe obstructive sleep apnea is due to the excessive daytime sleepiness or from damage done by reduced oxygen levels in the brain with each episode.

A multidisciplinary approach is used in treating obstructive sleep apnea. "There is no one treatment that all patients like and benefit from, so therapy has to be individualized," Phillips says. "In 1990 the first line of treatment is nasal CPAP (Continuous Positive Airway Pressure) and lifestyle changes." Other treatments include medication, surgery and use of a still-experimental intraoral device.

Anderson became part of a research study to compare the effectiveness of nasal CPAP and oxygen in treating apnea. Nasal CPAP "works by forcing air in through the nostrils and keeping the back of the throat open," Phillips explains. It effectively eliminates snoring and apnea.

But the patient must wear a mask over his nose while he sleeps. The mask is attached by hoses to a machine about the size of a small stereo speaker. "It is cumbersome, it is not sexy and it makes noise (about as much as a room air conditioner). But some patients with severe obstructive sleep apnea think it's wonderful because it does allow them to sleep restfully and peacefully for the first time in a long time," Phillips says.

The treatment is effective and has no significant side effects, but 40 to 60 percent of patients won't use nasal CPAP on a long-term

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Not "Sleeping Like a Baby"

"Rebecca" was born too soon. Born 32 weeks after conception, she was taken to the Neonatal Intensive Care Unit (NICU) in the Chandler Medical Center. One of Rebecca's problems was apnea of prematurity: during a 24-hour period, she would quit breathing 20 to 40 times.

The younger the gestational age of the newborn, the more likely a baby is to have apnea of prematurity. Infants born 26 to 27 weeks after conception (compared to the usual gestation period of 40 weeks) have only a 50 percent survival rate overall and almost 100 percent of those who do survive have the disorder, according to Nirmala Desai, a neonatologist who treats the babies in the NICU. In contrast, few babies born after 36 weeks develop apnea of prematurity. (Apnea may also occur in premature and full-term babies who have chronic lung disease and disorders of the central nervous system.)

As with adults, apnea in preterm babies occurs during sleep, but the babies rarely snore. If the baby is aroused, the apnea goes away. The disorder can be life-threatening if it goes on long enough, but the infants susceptible to it are usually closely monitored in a neonatal intensive care unit so "it rarely leads to any terminal event," says Robin Gilmore, associate professor of neurology and apnea researcher at UK.

Some preterm infants may have as few as two to four apnea incidents in a 24-hour period while others may have tens to hundreds of episodes. Repeated episodes can cause recurrent hypoxia (lack of oxygen) of the brainstem. "One of the effects of hypoxia in the newborn is to produce



Nirmala Desai

apnea, so it is a vicious cycle," Gilmore says. (In contrast, in an adult lack of oxygen due to apnea stimulates the person to start breathing again.) The baby's heart rate also slows down.

If an infant is having only a few apnea incidents, an effective treatment may be touching the baby to stimulate breathing. When the baby stops breathing in the NICU, monitors alert nurses who touch the baby to arouse it. If the baby's breathing is obstructed, a nurse may reposition the baby to relieve pressure on the trachea, which, because of the long necks infants have, is easily folded, Desai says. If incidents are more frequent, the baby may be placed on an apnea mattress, a tiny oscillating water bed. The movement stimulates the peripheral nerves, which send signals along the same pathways to the brain as those used in breathing.

Babies may be given oxygen, but the most frequent treatment, according to Desai, is a respiratory stimulant

such as theophylline or caffeine. Caffeine is the more effective drug, but because theophylline dosages can be more easily regulated, that drug is used most frequently at UK. Nasal CPAP is occasionally used. If none of these measures works, the baby may be placed on a ventilator to help it breathe.

"The majority of babies outgrow apnea of prematurity by the time they are ready to go home," Desai says. That's usually between 38 and 40 weeks of gestational age. When a baby reaches a weight of about four pounds and a gestational age of 35-36 weeks, NICU staff begin to make plans for the baby to go home. At this time, if the baby has no apneas for five or six days while still being given a respiratory stimulant drug, the drug is stopped and the baby is monitored for three or four days. If no apneas occur, the baby is then sent home without a monitor to signal if the baby stops breathing. If the apneas reoccur once the drug is stopped in the hospital, the drug therapy is started again and the baby is sent home with an electronic monitor.

"Certain babies definitely need to be monitored, but I, for one, do not advocate the routine monitoring of all babies (at home)," Desai says. In 1989, 68 of the 700 babies treated in the neonatal intensive care unit were sent home on monitors. Desai believes the number will be lower in 1990. ♦

basis, according to Phillips. That's one reason Phillips compared the effectiveness of CPAP and nasal oxygen in a study supported by the Sanders-Brown Center on Aging. Most of the subjects in the study were older people who sometimes have more trouble using CPAP than younger people. Nasal oxygen can be delivered by a small catheter under the nose and is much less restrictive than nasal CPAP. Giving a patient oxygen continuously throughout the night keeps the oxygen level in the blood from dropping as it does in untreated sleep apnea patients, Phillips found. The study showed that both CPAP and nasal oxygen resulted in some improvements in the subject's neuropsychological function, particularly in reaction time and attention span. But unlike CPAP, nasal oxygen did not improve daytime sleepiness.

Of the eight patients in the study, four chose to continue using nasal CPAP, two chose

patients with obstructive sleep apnea. Therefore, nutritional counseling and weight loss programs are an important part of the treatment for the disorder. Patients are also advised to avoid depressants such as sleeping pills and alcohol because they make apnea worse by depressing the respiratory drive. Since sleeping on the back increases the likelihood of apnea, patients are encouraged to sleep on their sides. To train themselves, some patients sew a pocket on the back of their pajamas and put a tennis ball in it. If they roll over during the night, the lumpy tennis ball wakes them up. Patients are also advised not to smoke and not to become overtired, because the most severe apneas occur in deepest sleep.

Drugs are not a first-line treatment for obstructive sleep apnea, Phillips says. The two drugs that have been shown to be somewhat effective, medroxyprogesterone, a female hormone, and protriptyline, an antidepressant, have major side effects and are only moderately effective.

Surgical therapy does not work for everyone either. The surgery, uvulopalatopharyngoplasty, involves removing extra soft tissue in the throat, particularly from the uvula and soft palate. The surgery has about a 50 percent cure rate, Cook says, although most patients do show some improvement. Surgery may also be used to correct malformations of the face or upper airway that obstruct breathing.

In conjunction with Ed Lyon of the College of Dentistry, Phillips, Cook and Berry are studying the effectiveness of an intraoral device to treat patients with mild or moderate obstructive sleep apnea. The smoke-colored plastic retainer-like device clamps over the upper and lower teeth and pulls the lower jaw forward so that an airway is left open. The device has been used fairly widely in clinical practice, but its effectiveness has not been extensively studied. Preliminary results are "promising," Phillips says.

Not everyone with sleep apnea needs or wants treatment. "For some people with mild sleep apnea, the treatment is worse than the disease," Phillips says. Those who elect no treatment are followed, she says, but "not everybody who stops breathing during sleep has problems we can identify." ♦

Sufferers have three times as many car wrecks as people who don't have apnea.

oxygen treatment, one opted for surgery and the eighth declined any further treatment.

Anderson chose nasal CPAP, and after sleeping with a face mask hooked to a machine most nights for almost two years, he is pleased with the results. He doesn't snore when he uses nasal CPAP and he no longer gets tired during the day. He gets eight hours of restful sleep. When he occasionally takes a night off from the machine or doesn't use it when he travels, he can tell the difference in how he feels the next day because, without CPAP, the snoring and apnea return. His wife has also benefited. Laughing, Anderson recalls his wife Ruth telling relatives, "It's helped a hundred percent: I can sleep now!"

Anderson, now 45, was also advised to make some lifestyle changes, specifically to lose weight. He has lost 10-15 pounds, but at 6 feet, two and a half inches, he still weighs 305 pounds.

According to Phillips, an overweight person who loses even 10 percent of his weight may cut the number of apneas per sleep hour in half. Losing 100 pounds will cure most obese

Making Babies: Would-Be Parents Aided by New Medical Techniques

by Leigh Gaines

It's stressful. It's expensive, and it doesn't always work. But for couples who can't have a child, in vitro fertilization (IVF) is a gamble many are willing to take.

At the Kentucky Center for Reproductive Medicine in the University of Kentucky Chandler Medical Center, nearly 100 couples each year roll the technological dice in an effort to become natural parents via the IVF procedure. Approximately one in five succeed.

The four-step procedure behind IVF sounds deceptively simple. First, hormone injections stimulate the woman's ovaries to produce eggs. The eggs, called oocytes, are then surgically collected. Fertilization marks the third step in which the man's sperm are mixed with the eggs "in vitro"—outside the woman's body. Finally, if fertilization occurs, the resulting embryos are transferred back into the woman's uterus in hopes of producing a pregnancy.

While infertility is slowly changing from a social stigma to a common problem, the growth and improvement of IVF techniques have prompted many couples to seek the help of professionals such as UK endocrinologist Michael W. Vernon.

"Twenty percent of all couples are infertile nationwide," says Vernon, a leading infertility researcher and a UK associate professor of obstetrics and gynecology. "People don't talk too much about infertility, but due to the changing sexual attitudes in the 1960s, there is an increased awareness of the problem."

So much awareness in fact that more than 100 clinics across the country are specializing in assisted reproduction techniques like IVF. For Vernon and the other researchers at the center, the goal is to help couples who have tried unsuccessfully to conceive a child for at least a year.

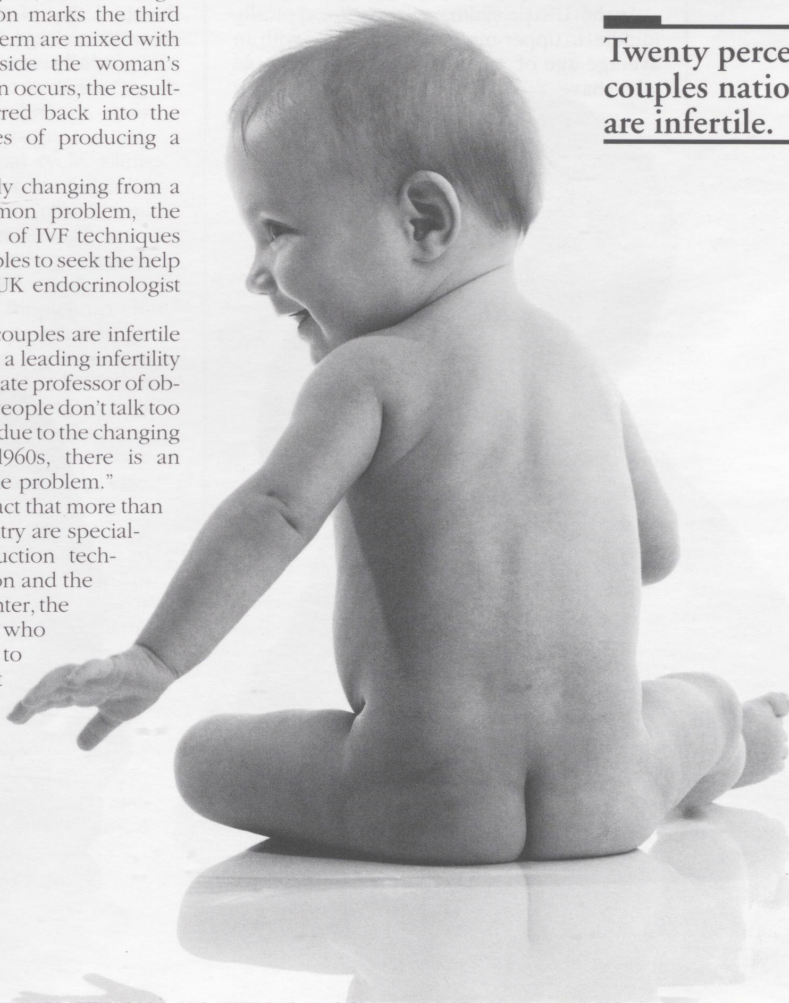
With the support of grants from the National Institute of Health and the March of Dimes, Vernon has centered his research around the problem of infertility, addressing the way different variables affect the development of the embryo. Current research projects range from endometriosis to the effect of heavy metals on embryos. Yet the goal is the same.

"The bottom line is infertility—all of our research is aimed at it," he says.

One key measurement of the research's effect is the success of the university's IVF program. Since June 1986, when the first in-vitro fertilization was performed, the center

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Twenty percent of couples nationwide are infertile.



“The fact that you can't have kids is constantly being rubbed in your face in our society.”

has helped to produce 25 babies by using assisted reproduction techniques. Although more than 100 patients a year are undergoing the rigorous treatment schedule, Vernon explains that the center would like to attract more infertile couples.

“We want to improve our success rate,” he says. “Even though two-thirds of all IVF programs haven't had a single baby, it's still a game of relativity. Our success rate is comparable with that of other programs that are producing babies.” Despite the unfavorable odds against pregnancy, couples undergoing the life crisis of infertility are often eager to accept the financial, physical and psychological hardships posed by in-vitro fertilization.

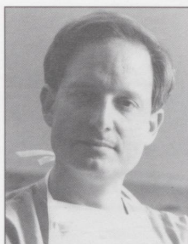
At the UK program, patients are typically middle-to upper-middle class couples with an average age of 34. “Many are career people who have put off having kids until their thirties, and then

find out they are infertile,” Vernon explains.

Because of the stressful nature of the program, couples are thoroughly screened before being accepted into the program. Age considerations, medical history, previous pregnancies, general health and ability to produce gametes—eggs and sperm—are the main criteria for acceptance. The UK program runs four treatment cycles a year with a 25-patient limit per cycle. Once a cycle is started, both clinicians and patients are submerged in the process seven days a week for close to two months.

The timing of the IVF treatment cycle is dictated by the 28 days of the woman's menstrual cycle. Actual treatment begins on the third day of the menstrual cycle when stimulatory drugs, usually a variety of hormonal products commonly called “fertility drugs,” are given to the woman to induce





Michael Vernon

several of the follicles in the ovaries to develop.

The medications stimulate more than one follicle so that when the eggs are collected, a process called oocyte pick-up (OPU), several eggs can be gathered at once. "We average six eggs per patient with each collection," Vernon explains.

At this point, the ethical question arises of what to do with the excess embryos. It is not uncommon for ten eggs to be collected in this process, and a record 26 eggs were taken in one collection. Ideally, only four embryos are transferred back into the woman's uterus. Replacing more than four increases the possibility of multiple pregnancies.

"Twins are often desired, but more than that compromises the woman's well-being," says Vernon.

In order to track follicle growth, daily ultrasound monitoring is begun on the eighth day of the menstrual cycle. Clinicians view actual images of the follicular growth on each ovary. This information, along with daily blood tests revealing hormonal levels, insures that optimal egg production and maturation have occurred.

When the eggs are ready for pick-up, clinicians use either laparoscopy or transvaginal oocyte retrieval. The laparoscopic procedure involves making a small incision beneath the navel and inserting a telescope-like device called a laparoscope. A needle is passed through the laparoscope into the ovarian follicle to remove the egg-containing fluid.

Alternatively, transvaginal oocyte retrieval avoids the surgical procedure by placing an ultrasound transducer, or "microphone," in the opening of the vagina. A needle is passed through the transducer, through the vaginal wall, and into the ovary, allowing the eggs to be removed. At the center, most IVF procedures use the transvaginal technique.

Oocyte culture and fertilization is the next step in the treatment process. Following aspiration, the eggs are placed in a special fluid medium for two to three hours. A

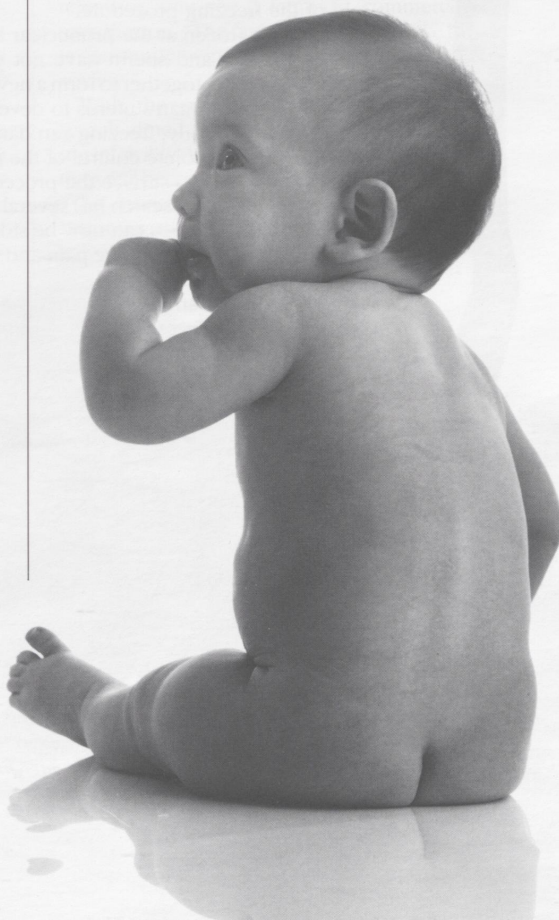
semen sample from the male is washed, incubated and placed in the medium with the eggs.

The sperm and eggs remain in the same environment for about 40 hours. The center's fertilization rate is 80 percent. If the eggs develop normally, the woman returns to the center two days later to undergo the final embryo replacement.

Unlike oocyte pick-up, this simple procedure requires no anesthesia. A thin plastic tube known as a catheter is inserted into the uterus through the cervix, and the embryos are transferred into the uterine cavity.

Approximately two weeks after the embryo replacement, a pregnancy test is performed. If a pregnancy develops, the patient is turned over to her primary care physician. If the treat-

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Kentucky's *First Cryopreservation Baby Arrives*

Every day, hundreds of breakthroughs are made in laboratories across the country. Yet no research result has the impact of a newborn baby.

At the Kentucky Center for Reproductive Medicine, its work on cryopreservation—the freezing of live embryos—has made headlines in both the scientific and public communities: In May of 1990, a woman gave birth at Lexington's Central Baptist Hospital to an IVF baby who developed from a frozen and thawed embryo. This pregnancy marks the research team's first successful human application of cryopreservation. Only IVF programs in Chicago, Atlanta and Los Angeles have duplicated the results.

With the help of a grant from the March of Dimes Foundation, Michael W. Vernon, along with researchers Nancy Pedigo, Kathy Sharpe and Maria Bertero, are continuing to study a mouse model for IVF and cryopreservation. They have been able to apply what they've learned from this research on the mouse to human patients.

"The great thing about this research is that the outcome is a baby—not some esoteric finding," says Vernon. Sixteen patients in the center's IVF program have had their extra embryos frozen. Although only one has gone on to produce a full-term pregnancy, any patient who has multiple embryos is told of the freezing procedure.

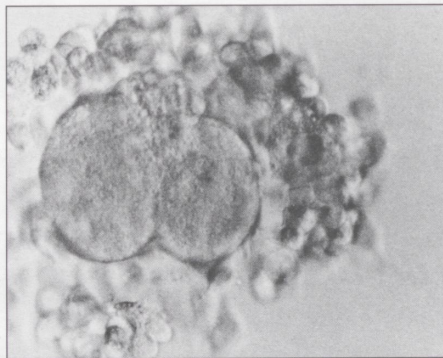
Embryos are frozen at the pronuclear level, meaning that the chromosomes of the egg and sperm have not yet joined. After thawing, these pronuclei will come together to form a new individual, and the embryo will be placed in the woman's uterus to develop.

"If not done properly, freezing can damage the embryo," says Vernon. "The secret is an absolute control of the rate of freezing which enhances the embryo's ability to survive the procedure."

The success of this research has several implications for women undergoing IVF. Extra embryos can now be stored and used in future IVF procedures, sparing the patient the pain and cost of going through hormone treatments and oocyte pick-up.

"With cryopreservation, there are no daily injections of drugs and no major surgery to collect the eggs," Vernon explains. "We just monitor the cycle and implant the frozen and thawed embryos nonsurgically through the cervix."

Perfecting the cryopreservation procedure will also mean improvements in IVF pregnancy rates. With continued research, Vernon hopes that cryopreservation will become a standard and successful step in the IVF procedure.



A two-cell embryo that was frozen, stored, thawed and transferred back into a patient's uterus. The patient gave birth to the first cryopreserved baby born in Kentucky.

One of the major causes of infertility is a disease known as endometriosis, a malfunction of the menstrual cycle.

ment fails, patients generally must wait three to four months before attempting another cycle. With costs averaging around \$5,000 per IVF cycle, multiple attempts are both financially and psychologically draining.

In fact, because the treatment schedule virtually takes over a participating couple's lives, the day-to-day stress is enormous, says Vernon. "Although the data says stress does not affect the outcome of the procedure, it seems like the more relaxed people are more often successful," he notes. Stressed out or not, couples often come to the IVF program as a last chance to have a baby.

One of the major causes of infertility is a disease known as endometriosis, a malfunction of the menstrual cycle. It occurs when bits of the endometrium (lining of the uterus), that are usually sloughed off and discharged through the vagina, move in the opposite direction and become lodged in the abdominal cavity. Once attached, they grow like the normal endometrium tissue, causing intense pain and, many times, infertility.

Under the sponsorship of an NIH grant, Vernon is researching several aspects of the disease in hopes of alleviating infertility for couples before they are forced to seek help from programs such as IVF. "The majority of our patients come to IVF because of endometriosis," says Vernon, who has studied uterine physiology for more than 10 years. "In part of my research, we are using proteins unique to the uterus and endometriotic implants in order to diagnose endometriosis."

If these proteins can be identified in the peritoneal cavity, the need for surgery as a diagnostic tool may be eliminated. In addition, physicians are now able to alleviate the symptoms and infertility using steroid drugs

and new techniques, such as laser surgery.

Other couples come to the IVF program due to severe male infertility, in which the male exhibits a low sperm count and/or low sperm motility. According to Vernon, 40 percent of the center's patients suffer from male infertility. In this case, couples may try Gamete Intra-Fallopian Transfer (GIFT).

The GIFT procedure is similar to IVF except that the collected eggs and sperm are placed directly into the fallopian tubes for fertilization. That is, GIFT mimics the way eggs and sperm normally meet and develop. The success rate is also higher—30 percent of GIFT patients become pregnant.

Whatever the causes of infertility, the effects on the childless couple are the same. "Families are always asking when you are going to have children, and every time you turn on the television you see a Pampers commercial," says Vernon. "The fact that you can't have kids is constantly being rubbed in your face in our society."

With the continued advancement of research aimed at both curing and circumventing infertility, Vernon hopes that more alternatives will become available for infertile couples. "The more socially acceptable the problem becomes, the more research will be done to solve it." ♦



Moving Mountains: The Star Fire Project in Eastern Kentucky

by Jeff Worley

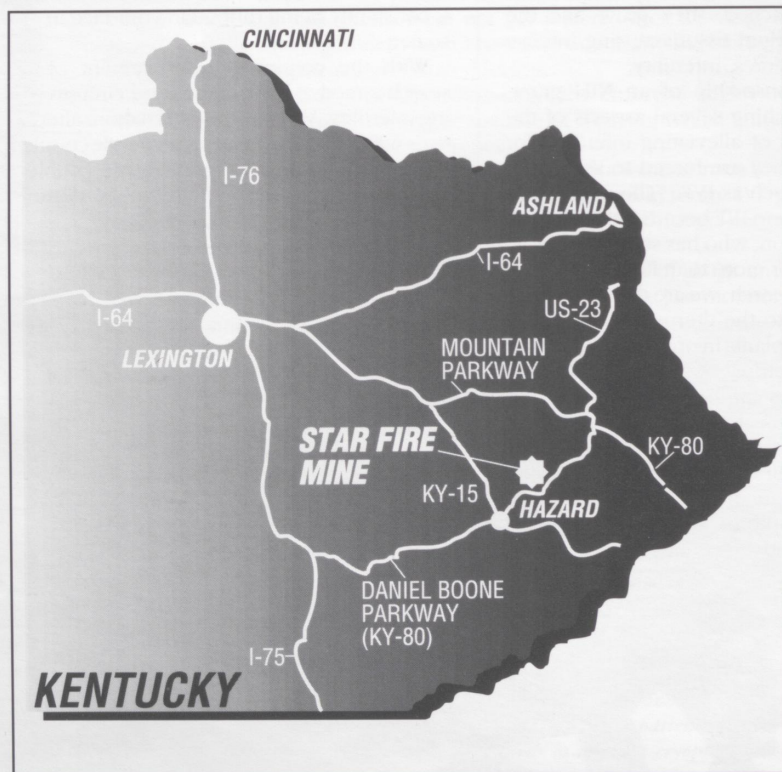
When asked about a current project he's involved in, James Dinger can truthfully say the results have been earth-shaking. As the head of the Water Resources Section of UK's Kentucky Geological Survey, Dinger is directing a program which involves mountaintop removal at a coal mining site 15 miles north of Hazard in Eastern Kentucky. The goal of the program is to create land for building and developing and, at the same time, establish an underground reservoir of water for local use.

"The Eastern Kentucky coal field, like much of Appalachia stretching from New York state to Alabama, is characterized by a lack of sufficient water supplies to support urban and industrial development," Dinger says. "Where

development has occurred, it has predominantly taken place in the floodplains along major rivers or streams that provide both a water supply and flat land."

He explains that most of the best land in the Eastern Kentucky coal field was settled decades ago, leaving for future development only steep hillsides or flat land highly susceptible to flooding. "Apart from the few rivers that cross the region, water supplies are available mostly through the use of cisterns, which often go dry in the summer months, and ground water from springs and wells, generally producing less than several gallons a minute," Dinger says.

Current plans at the Star Fire site call for the conjunctive use of ground and surface water. Ground water will move into the aquifer, a geologic formation that stores and transmits



The Star Fire Project is currently underway at a site 15 miles northeast of Hazard, Kentucky.



James Dinger

water underground. The aquifer is being generated in the mine spoil which is formed when rock material is broken up, removed from covering the coal beds, and dumped into pre-existing valleys and open pits. The spoil will average 200 feet in thickness over the 5,000-acre tract.

"In the process of mountaintop removal mining, two things are accomplished at once," Dinger says. "Flat land is created and, in filling the valleys with shale and sandstone spoil, 'transportation corridors' are provided for water so that it can be recharged into an underground reservoir."

He explains that because of the steep topography in much of Eastern Kentucky, rainwater tends to run off quickly from hills and mountains into streams and rivers. By creating an aquifer, the water can be trapped and stored for underground use.

In the process of creating spoil, hollows

bordering the mountain ridges are first filled with loose rock. The top of the mountain is then dynamited, blasting the bedrock into rubble. Huge cranes dump bucketsful of the spoil into the valley below, where gravity tends to sort the aggregate—the larger, heavier rock fragments separate from the finer material and accumulate from the bottom up. As mining continues, the layers of porous spoil combine to create interconnected pathways for groundwater movement. "Water moves slowly through the spoil," Dinger says, "and it doesn't evaporate underground as it would from a surface reservoir."

Dinger and Richard Warner, from UK's Department of Agricultural Engineering, became involved in this project after the Kentucky Geological Survey was contacted by representatives from Cyprus Mountain Coals, based in Eastern Kentucky. "Most coal companies operating in Eastern Kentucky have little interest in land development," Dinger says, "because they own only the mineral rights to the properties they mine, not the land surface." Cyprus Mountain Coals is unique, he says, in that it owns the 17,000 acres at the Star Fire surface mine and, therefore, has considerable interest in post-mine development of the property. Dinger estimates that 5,000 acres of flat land will be created by the year 2007 through mountaintop removal techniques, which will provide sites for new land uses and economic development.

He says that though the project is in its early stages, three wells have already been drilled in a 1000-acre area so that the water table can be measured and the mineral content determined. "Coal needs to play a much less important role in the economy of Eastern Kentucky," Dinger says. "The Star Fire Project is one way to work toward the necessary economic diversification in the area."

The project is funded by the Cyprus Mountain Coal Company and the Kentucky River Area Development District through a grant from the U.S. Economic Development Administration. ♦

Rock Fences of the Bluegrass

by Jeff Worley

Karl Raitz was a student traveling through the Lexington area back to his native Minnesota when his love affair with Kentucky began. "I was swept off my feet by the beauty here—the topography and the wonderful structures people had built on the land. In Minnesota the buildings, the fences, most of the man-made structures are less than a century old. In the Bluegrass you have well-tended houses and other buildings over twice as old."

As luck would have it, a visiting professorship in geography at the University of Kentucky became available in 1970, and Raitz got the job. "I felt very fortunate—and still do—to be living in such a beautiful place. For me, the pastures, the rolling green hills, the whole landscape ensemble is very therapeutic."

Over the past two decades Raitz, an historical geographer, has become even more intrigued by the man-made structures in the Bluegrass, specifically in how they came to be built. "Two years ago I decided to focus my studies on the rock fences in the area," Raitz says, "which play a small part in this history." So he and Carolyn Murray-Wooley, an architectural historian with a strong background in identifying and researching historical buildings, teamed up to make an intensive study of rock fences of the Bluegrass—their construction, morphology, and historical significance.

When he first came to Lexington, Raitz

believed (like almost everyone else he had talked with) the pervasive myth of how these fences came to be built. "I was under the impression that all of the fences were built by slaves before the Civil War and black freed men after the war," says Raitz, a professor of geography and anthropology. "We now have proof that this is only partly true." The fact is, though, this belief has become deeply entrenched in the history/lore of the Bluegrass. No less a source than *The Wall Street Journal* published a front-page article last April on Kentucky's Madden family, an article that included the misinformation that "the stone fences" were "built by slaves."

One goal of the research project was to correct such misconceptions. But Raitz and Murray-Wooley hope the significance of the study will have other far-reaching effects as well. "The rock fences of the Bluegrass are important to Kentucky as one of the most distinguishable symbols of the Bluegrass land-

“It became clearer and clearer that Irish stonemasons built—or supervised the building of—practically all of these old 19th-century fences.”



scape," Raitz says. "They are important on the national level as the most extensive collection of quarried rock fences still standing in the U.S." Their significance, he says, derives from the distinctive character of their methods of construction, and because as a collection they give us historical information about the evolution of the cultural landscape of the Bluegrass region.

The researchers' ultimate goal was a very specific one: to provide the Kentucky Heritage Council with a detailed historical context statement that would become the basis for nomination of large segments of rural property for historic preservation status. Such status, Raitz says, may aid rural landowners in defending their property against construction projects (such as road construction) that would remove structures, change historic road alignments, and remove 200-year-old park land.

The key word here, Raitz explains, is "context." "What we knew we had to do was discover why the fences were built, what materials were used, who did the contracting, who did the building, what techniques they used, and so forth."

In their reconstruction process, Raitz and Murray-Wooley used a myriad of survey methods. In order to first locate existing rock fences, they sent letters to the county agricultural agent in each county of the Bluegrass region in which rock fences were thought to exist. The agents were asked to mark on county maps known locations of rock fences. The maps were then used as guidelines for



Carolyn Murray-Wooley and Karl Raitz examine a level coursed dry-laid rock fence near the Kentucky Horse Center off Paris Pike.

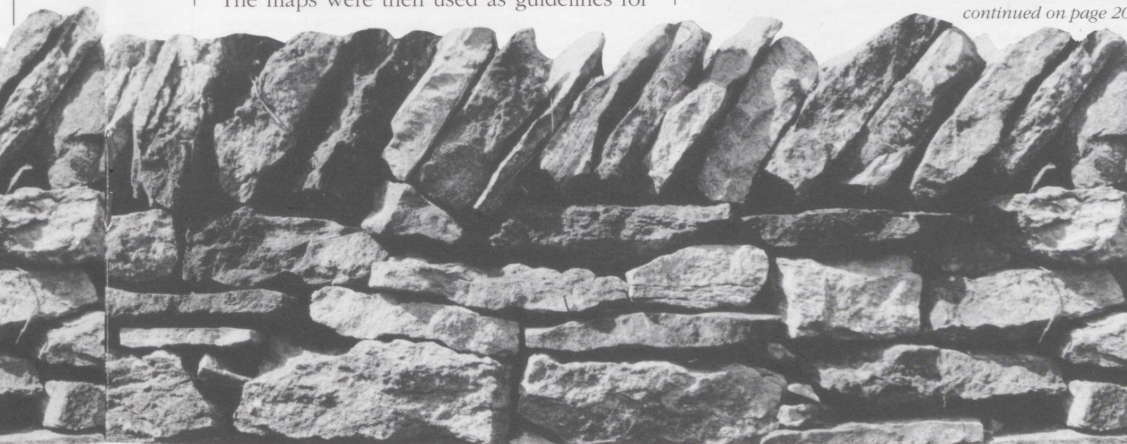
what Raitz calls a "windshield survey" of reported rock fences.

The researchers then began an intensive study in the UK archives and Kentucky Historical Society to locate farm records describing the cost, time, labor, and materials used for the construction of the fences. In their search, Murray-Wooley says, the collection of the Clay family papers was especially revealing.

"Brutus J. Clay, a large and wealthy landowner in the mid 19th century in Bourbon County, directed the construction of stone fences on the perimeters of the fields, lots, and yards of his plantation. And he kept records of everything—I think he must have kept every slip of paper that came in his front door. These records tell us the names of the persons he hired, the amount of money he paid them, and the dates of construction." Over the years (1839-1876) 21 Irish stonemasons worked for Clay and two slaves assisted them at various times.

Murray-Wooley spent dozens of hours reading microfilm copies of U.S. Census manu-

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If a roadway needed to be widened to comply with the 30-foot legal requirements, then fences may have been taken down, moved to the side, or simply broken up and used as aggregate in the road surface.

script records for the year 1850 for all the Bluegrass counties (the first year in which "occupation" is listed), through 1880 for Anderson County, and for 1850 through 1920 for Bourbon and Woodford counties. From these censuses, she made lists of all persons having the occupation of stonemason. "From these records, and leads collected from other sources (historical groups, county librarians, courthouse records, newspaper reports, and Shakertown records), we put together an amazingly long list of fence masons—those who worked during the 19th century and those currently working in the region on the repair of historic fences and the construction of new ones," Murray-Wooley says. "I then contacted the fence masons and interviewed

them about fence construction and terminology.

All of these disparate sources led the researchers to an exciting discovery—the corroboration of what Raitz calls "The Irish Connection." "Once we started talking to people, it became clearer and clearer that Irish stonemasons built—or supervised the building of—practically all of these old 19th-century fences." What the researchers needed to do now was establish a "triangulation" of sources, disparate evidence that the Irish, not slaves, built the fences.

"Research on stone house and mill construction had already established that Ulster and Scottish settlers were in Kentucky by the 1770s, and we found a high correlation between their stone buildings and the locations of rock fences," Murray-Wooley says. Raitz adds that Scotland, northern Ireland, and northern England have rock fences (there called "dykes") exactly like early Kentucky fences, and Shaker records for Pleasant Hill in Mercer County show a number of Irish masons who were paid for their work on the roads and fences.

During the Irish Potato Famine in the 1840s, increasing numbers of Irish emigrated to America, and a number made their way into Kentucky where they found work as turnpikers and masons, using skills developed over several generations of stone construction in Ireland. "By 1850 the manuscript census listed 117 turnpikers in Bourbon County," Murray-Wooley says, "113 of whom were born in Ireland." By 1870 there were 36 stone masons from Ireland, and 11 from Kentucky, four of whom were black. Through the years the number of masons from Ireland gradually declined while the number of black masons increased; by 1910, 23 of Bourbon County's masons were black, one was Irish, and seven were whites (probably second-generation Irish) born in Kentucky.

"A few farm records suggest that farm slaves assisted in fence construction as laborers," Raitz says. "The stone mason was, to use contemporary terms, the 'lay-up man,' assisted by men who brought the rock from the quarry site or creek bed to the construction



James Rebmman, senior planner, and Wilma Beall, office manager in the Lexington-Fayette Urban County Government Division of Planning, use a Rolatape to measure the length of a stone fence along Johnson Pike, three miles northeast of Lexington.

site." In this way, Irish knowledge of rock fence building technique and the use of proper tools in working stone, was passed on to the other laborers working the fences, some of whom were slaves or, later, freed black men.

"All the information was pointing the same way—toward the Irish," Raitz says. "Then one day we responded to a tip from a longtime Harrodsburg resident named James Huff. His family is related to an Irish stonemason named McCrystal whose father, Huff said, was 'born on the water.' McCrystal lived in an area called Irish Ridge in the western part of Mercer County. So Carolyn and I went to the area and found ourselves searching through a graveyard for a marker that said McCrystal: it was the last marker in the corner of the graveyard."

Raitz describes the face of the gravestone as ordinary, a plain face with the name Mike McCrystal (b. 1842) carved into it. But the rest of the marker was anything but ordinary.

"The gravestone was carved in the shape of a stone fence, about forty inches high," Raitz says. "When I saw this, I felt a tremendous surge of connectedness." "It was almost too good to be true," Murray-Wooley says. "I walked behind the stone, stretched my arms out, and just fell into the tall grass I was so pleased with the discovery—here was a fortuitous bit of tangible evidence, a symbol of what this Irishman had done all his life." (When asked if Mike McCrystal may have made the marker himself, Raitz responds that "it's an interesting possibility.")

Given the fact that building a stone fence—and some of these stretch for miles along property lines in the Bluegrass—is laborious, time-consuming work, why were these fences constructed in the first place?

"A major reason why they were built in the Inner Bluegrass," Murray-Wooley says, "is that they were more substantial than wood fences; they didn't have to be replaced every few years. The fences were also symbols of permanence and prestige." "Another reason is to get stone off the land," Raitz explains. "When a farmer plows the steep slopes of the Eden Shale Hills section of the Bluegrass, he pulls up or plows up lots of stone. Rather than lug it off somewhere, he decides to put it to use."

A third reason has to do with 19th century Kentucky fence law. A critical problem for

The fences, built primarily because they were more substantial than wood fences, also stood as symbols of permanence and prestige. Another reason for building them was to get stone off the land and put it to use.

livestock farmers was confinement of their stock. To be sure that he wouldn't be subjected to a fine, a farmer had to have "legal" fences built to specification. The law required not only that stock owners fence their stock in; it also required that other farmers have strong fences to keep another's stock out, or the farmer with the weak fence could be fined. When timber for traditional rail fences became scarce and expensive in the 1820s and 1830s, rock fences became more prevalent.

Different laws that were passed to foster road improvement led to a number of these rock fences being removed from the farms. These laws indicated that road workers could go onto adjoining property to obtain rock for construction use, so if a roadway needed to be widened to comply with the 30-foot legal requirements, then fences may have been taken down, moved to the side, or simply broken up and used as aggregate in the road surface.

"As highway construction became increasingly demanding of space and right-of-way, narrow fence-lined lanes would have given up their fences as these roads were widened and straightened," Raitz says. Many rock fences, he adds, may have been removed after mechanization was introduced into farming after the 1880s, especially after tractors came into use. "The interior fences had to go to make room for the tractor," Raitz says.

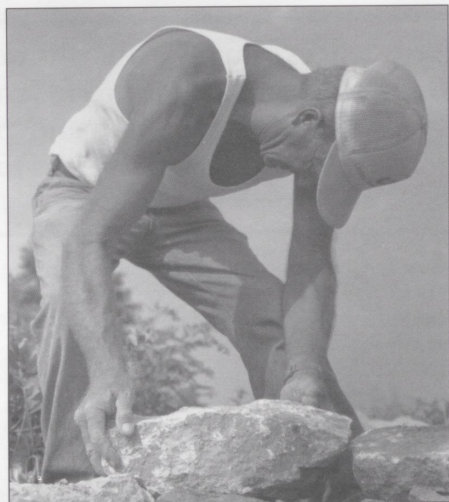
In the last 30 years or so, many of the fences have been lost through urban expansion, he adds. "Last year a stone fence one-fourth of a mile long was bulldozed down inside of New Circle Road. Thirteen hundred feet of historic fence gone in two hours!"

Raitz explains that this fence, like almost all fences in the area, was constructed of limestone. "In the Inner Bluegrass the masons built

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“ Last year a stone fence one-fourth of a mile long was bulldozed down inside of New Circle Road. Thirteen hundred feet of historic fence gone in two hours! ”

Benny Higgs, a rock fence builder for 20 years, works on the reconstruction of a fence along Old Frankfort Pike.



with what they had on hand—no one in his right mind is going to lug rock very far. The rock closest to the surface here is called Lexington limestone, usually under from two feet to twelve feet of topsoil. So the rock had to be quarried out in hillsides near places of fence construction.”

The material used for construction was different in the more rugged Eden Shale Hills area, circumscribed by a rough arc 30 to 50 miles around Lexington to the south, west and north. In these areas, field rock was readily available for fence construction. Each passage of the plow, each new cultivation season, brought more rock to the surface. To dispose of the rock, it was logical to use it to build fences.

Though the building material was easily found, the fences are relatively complex structures. The rocks must be fitted against one another in such a way that, without mortar, the finished structure can stand indefinitely. Even if the material is quarried, no two rocks are alike, making the rock fence a very different structure from one built of brick. The physics of gravity and the annual freeze-thaw cycle conspire to force the mason to carefully con-

sider slope angles and direction as well as the form of the rock in deciding what particular techniques to use.

The most common rock fence type in Kentucky is known as level coursed dry-laid rock fence. “This type is found in the Inner and Outer Bluegrass,” Raitz says, “and in scattered places in the Pennyrile. These fences are usually built on gently rolling to level land using quarried rock, creek rock or field rock.” The rock fences of the early 19th century, distinguished by their diagonally placed coping (top row of masonry) standing on the top of the fence, usually surround barnyards, stock yards, paddocks, house yards, cemeteries, gardens, pastures and fields, and form the boundaries between land owners.

The other choice in dry-laid fences in the Bluegrass was a diagonally coursed pattern, locally called an edge fence. Like a long shelf of books or a line of dominoes, the stones support each other. “Edge fences are built by laying large and small stones upright at a slight angle. This arrangement is a wonderful adaptation to steep terrain,” Raitz says. This type of fence is usually found near the Kentucky River gorge and in Eden Shale country.

One result of this research has been that the report sent originally to the Kentucky Heritage Council, which funded the project, has grown far beyond the bounds of a report. “We’re working on a book manuscript now which will be submitted within the year to the University of Kentucky Press,” Raitz says. (The book’s tentative title is *The Gray and the Green: Rock Fences of the Kentucky Bluegrass*.) Publication of the book may be yet another step in the researchers’ ultimate goal of nominating some of Kentucky’s rock fences for historical status.

“Rock fences are a unique landscape resource in Central Kentucky,” Raitz says. “The few remaining fences serve as a small sample of what was, by the 1870s, the most extensive network of quarried stone fences in North America. The rock fences of the Bluegrass represent an important link with the settlement history of the state and serve as reminders of the colorful and complex cultural process that has produced the present-day landscape we live in.” ♦

The Cross-Fertilization of Knowledge: UK's University Studies Program

by Claudia Haller

The almost universal cry among undergraduates is, "Why do I have to take this course?" A University of Kentucky freshman wonders how learning Spanish will help him in the field of biochemistry—the career he hopes to pursue after graduate school. A second-semester sophomore wants to teach young children how to read. Why in the world, she asks, should she be forced to take Algebra 109?

Such questions have been echoed by countless students as they work with their advisors to put together a cohesive package of courses—a solid foundation for graduate studies or the first post-graduate job.

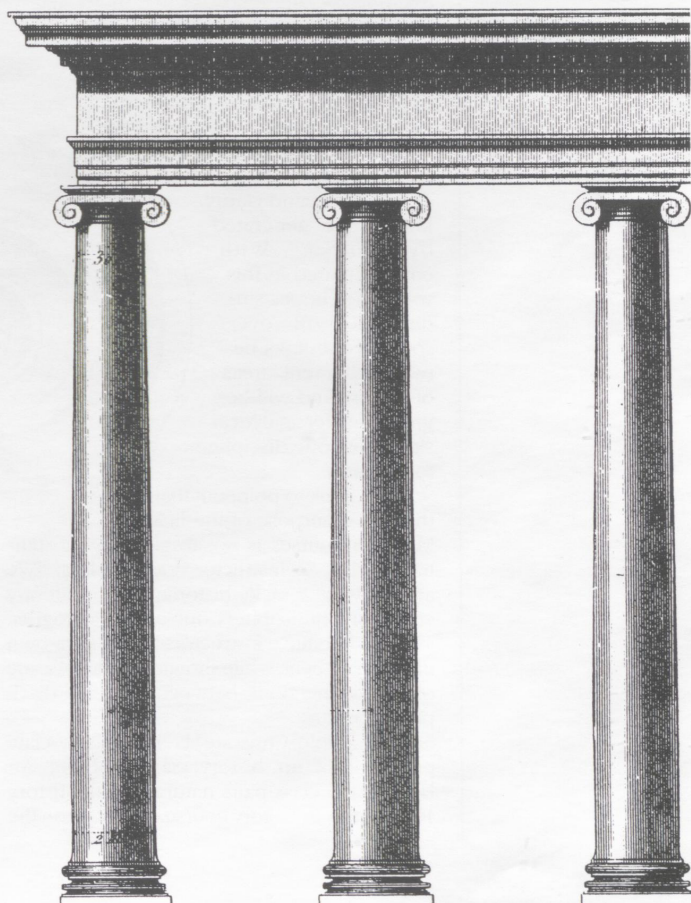
To address this issue, the University of Kentucky undertook a three-year study of undergraduate education. Conducted by a campus-wide committee of faculty, students and administrators, the study pointed to the need for a new, general education program.

The new program, called University Studies, was established in the fall of 1988 and is a comprehensive revision of the curriculum, providing a more coherent and broadly based undergraduate experience than existed before.

Prior to the introduction of the University Studies program, students had the option of selecting any five areas of study from a total of eight in order to fulfill their distribution requirements. Unless required to do so by individual colleges or departmental programs, a student could graduate from UK with a B.A. without so much as an introductory course in a foreign language or any college work in mathematics. In fact, for more than a decade, English composition has been the only university-wide graduation requirement.

The University Studies Program prescribes for all students a core curriculum which includes English, mathematics, foreign language, and oral communication, as well as work in the humanities, social sciences and natural sciences. The new requirements also stipulate that all undergraduates must take a

“We want to help students appreciate the fact that knowledge generated by one discipline can enhance and clarify knowledge generated by another.”



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pair of courses (six hours) which have been designed to show the relationship between one discipline and another (the cross-disciplinary requirement).

According to Louis J. Swift, director of the University Studies Program, the program represents both a return to traditional forms of a liberal arts education and a venture into new dimensions of undergraduate study. "This program now applies across the campus," says Swift. "It provides a solid base upon which colleges and departments build their degrees and it gives students a broad acquaintance with the principal areas of human inquiry."

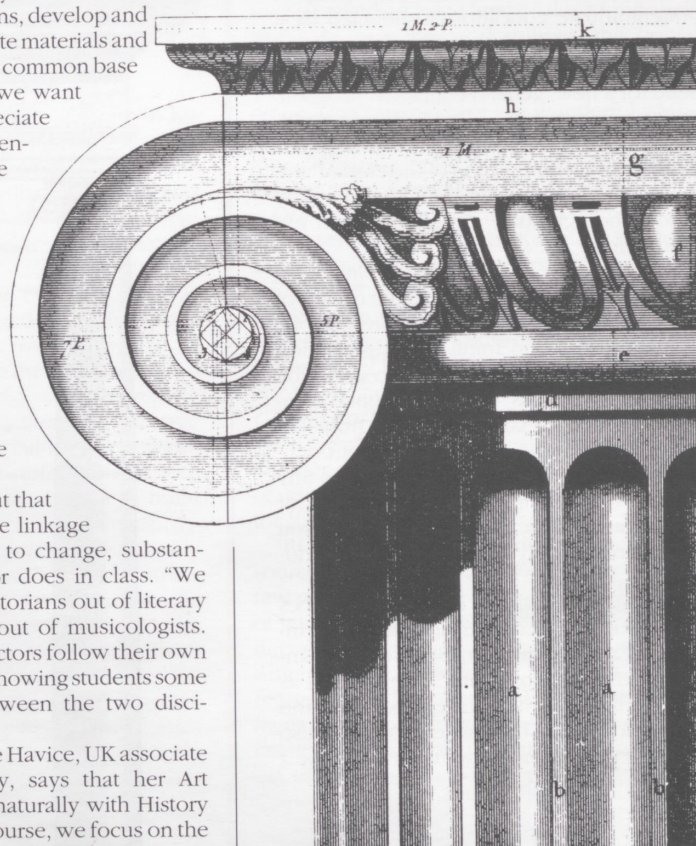
The purpose of the cross-disciplinary requirement is twofold according to Swift. "First, we want to give students the chance to explore the different ways that individual disciplines frame questions, develop and test hypotheses, investigate materials and reach conclusions from a common base of knowledge. Second, we want to help students appreciate the fact that knowledge generated by one discipline can enhance and clarify knowledge generated by another." With courses paired in this way, Swift hopes students will discover some of the links between different areas of inquiry and will begin to transfer analytical skills from one discipline to another.

He is quick to point out that the major purpose of the linkage between courses is not to change, substantially, what an instructor does in class. "We aren't trying to make historians out of literary critics or philosophers out of musicologists. The aim is to have instructors follow their own disciplinary bent, while showing students some of the connections between the two disciplines."

For example, Christine Havice, UK associate professor of art history, says that her Art History 105 class pairs naturally with History 104. "In the art history course, we focus on the

classic Greek forms of architecture and art objects such as the male nude," Havice says. "During the discussion of these topics as works of art, we talk about the Persian sack of Athens and we read Pericles' funeral oration so students can gain a perspective on the context in which these works of art were

“Students shouldn’t study architecture in isolation from history, art and music.”



created. We talk about the development of geometry in Greece and how this relates to the architectural developments of that period; and we discuss developments in philosophical concepts and their impact on artists of that period."

When Havice teaches medieval architecture, she incorporates concepts that might normally be studied in Music 201. For example, she discusses the Gregorian chant and its development in response to the type of building in which it was sung—large vaulted cathedrals that produced a mellow echo and enhanced the power of the chants.

The initial response from UK faculty to the idea of paired courses was generally favorable, and a number of professors developed new courses or reworked existing ones to fit the new requirement. Initially, 35 pairs of cross-disciplinary offerings were approved by the University Studies Committee, ranging from the traditional linking of such areas as medieval history and medieval art, to the rather unusual pairing of a course in food sciences with an anthropology course on food and culture.

There was a commendable degree of diversity in the offerings initially approved, but since many of the pairs of courses were in the upper-division level the need to increase faculty participation became apparent. The courses initially developed would not suffice for the large numbers of students who needed to be served. It became clear that the only way an adequate number of courses could be provided for the cross-disciplinary component would be to link lower-division survey courses, which have larger enrollments.

The University Studies Committee met this challenge by allowing students to integrate the humanities component (six hours) of University Studies with the cross-disciplinary component (six hours) through a series of coordinated courses.

Most faculty members responsible for teaching the introductory courses in literature, history, art history, theatre and musicology agreed to rework these offerings to make clear the relationships among various disciplinary approaches.

The committee decided the sequences would be clustered around two broad categories



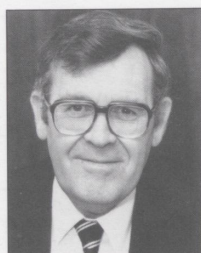
Christine Havice with UK sophomore Kevin Hopper. In July of this year, Havice will succeed Raymond Betts as director of the UK Honors Program.

defined as American Studies and Western Traditions. Students taking any two of the sequences in either category for a total of 12 hours would satisfy both the humanities component of University Studies and the cross-disciplinary component.

The value of this approach is both academic and practical, according to Swift. "Academically, the clustering of courses means that students will have extensive experience in a particular area of inquiry and will come away with a more comprehensive and coherent understanding of their intellectual heritage." As an example, he says that reading selections from *The Canterbury Tales* in a European history course as well as in a survey of Western literature course will make it easier for students studying Western traditions to understand the cultural forces at work in the late Middle Ages, and to see how different disciplines sort these forces out.

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“It’s exciting to take a new approach after teaching the same way for a number of years.”



Louis Swift

Swift points out that while the proposal to create clusters of courses was scarcely a radical innovation, it represented a significant departure from the way things had been done at UK in the past. “Habits developed through disciplinary research and long-standing practices in teaching large courses in the humanities militate against the kind of cooperative effort we envisioned,” Swift says.

With the need to develop coordinated sequences in American Studies and Western Traditions in the University Studies Program, it became apparent that the only way to achieve this goal was to set aside a period of time for the instructors of these revamped courses to exchange ideas and information. So Swift applied for and received funding from the National Endowment for the Humanities (NEH) to cover the costs of conducting two seminars for the humanities faculty at UK in the spring of 1988. The objective of the meetings was to rework syllabi in such a way as to highlight some of the common interests, problems, issues and values inherent in the humanistic disciplines.

Specifically, the three-week seminars (one for American Studies and one for Western Traditions) offered the 29 faculty members who attended the chance to study particular texts, monuments, events and issues which create a natural link between the courses that were under consideration and that could be profitably examined from a number of vantage points.

Havice says she was excited about the seminars because they gave her an opportunity to find out what was going on in her colleagues’ class-

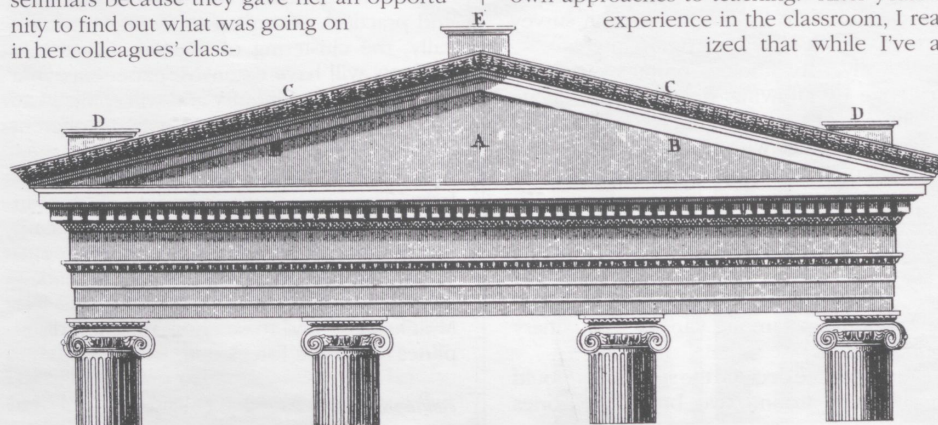
rooms. “It was a chance,” says Havice, “to observe the teaching styles of other professors through sample lessons. We began to call the seminars ‘culture camp’ after the first week because we were enjoying ourselves so much. And as a result, since then many of us have observed the others’ classes to improve our grasp of both the material and our colleagues’ approaches.”

Those professors who have implemented the cluster concept have reported positive results. Geraldine Maschio, associate professor in the Theatre Department, was enthusiastic about the concept from the start. “I’ve always used the cross-disciplinary method in my classes, and when the opportunity came along to do this in a more formalized way, I was eager to become involved,” says Maschio. “I think it’s important, for example, to illustrate for students the impact of music, literature and art on the history of the theater.”

Maschio feels that the cluster concept is having a positive impact on her students. “They are able to bring the experience and knowledge gained in other courses to my class.”

Joan Blythe, associate professor in the English department, embraced the cluster concept because she believes that all knowledge is interrelated. “Students shouldn’t study architecture in isolation from history, art and music,” says Blythe.

She is also attracted to the emphasis that the cluster concept places on teaching, and her involvement helped her to re-examine her own approaches to teaching. “After years of experience in the classroom, I realized that while I’ve al-



“After years of experience in the classroom, I realized that while I’ve always regarded myself as a pretty good teacher, there are things I could have done better.”

ways regarded myself as a pretty good teacher, there are things I could have done better. The seminars gave me an opportunity to learn from some of my colleagues. It’s exciting to take a new approach after teaching the same way for a number of years.”

Maschio feels that the “liberal arts approach” of the cluster concept can succeed at a large university. While she feels that the participation should be closely monitored and evaluated, she believes the cluster concept is at UK to stay. “The implementation of this approach is difficult in a large research university that has traditionally been so discipline-specific. But as opportunities are provided to share successes with other faculty members, I feel that other departments will become involved,” says Maschio.

In the fall of 1989, a formal proposal was made to the University Studies Committee to incorporate all of the American and European survey courses in English, history, philosophy, theater arts, music and art history as clusters in the new general education program, and all of the courses are now officially part of clusters in the University Studies Program.

As a result of the cluster concept, says Swift, students will come to class with a richer background than would otherwise be the case, the level of discourse will be higher, and the classroom experience will be more satisfying for the student and the instructor.

Kevin Hopper is a student in the clustered courses Art History 105 and 106 and History of

Europe 104 and 105. Hopper, a sophomore, has become fascinated by how material in these courses has dovetailed. “The clustered courses give you a broader background to reason things through—they help you to think about the big picture instead of focusing on details in isolation. I think the opportunity to look at concepts in their historical or cultural context has helped me develop my reasoning skills,” Hopper says.

Because he has yet to declare a major, and is not ready to make the decision, Hopper feels the clustered courses provide a broad scope of interest and information. “Because I don’t know what my major will be,” says Hopper, “I want to be exposed to a wide range of things right now.”

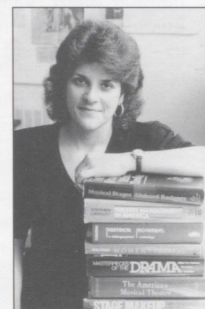
Participating departments have agreed to have all sections of the surveys taught in ways which reflect common issues. Consequently, teachers who did not participate in the 1988 seminars will be involved in the program, the number of students who take the clusters will increase and a reasonable degree of uniformity among the various sections of the courses will be assured.

Swift cautions that it is important to view the institution of the cluster concept as an ongoing process, “By 1990-1991, the clusters will have been in place for two years, and we will be in a much better position to measure their impact in qualitative terms,” says Swift. “But from recent comments made by faculty both on the Lexington campus and at the community colleges who have adopted the program, the cluster concept is taking hold and winning acceptance.”

The full impact of the 1988 seminars will not be felt for several years, says Swift, but he added that “we have taken a very important first step. We have demonstrated that the lines of demarcation which set one department apart from another shouldn’t keep us from examining issues or dealing with problems of undergraduate education in a more coherent and comprehensive way than we have done in the past.” ♦



Joan Blythe received a University of Kentucky Alumni Association Great Teacher Award for 1988.



Geraldine Maschio

RESEARCH BRIEFS

On the Road to Better Infant Health Care

Three days a week for the last year and a half Cheri Woodson and Carol Rushing-Carr have driven a maze of rural Kentucky roads, visiting the families of infants and toddlers who have, or are at risk for having, severely handicapping conditions.

They deliver a service that is at once basic and remarkable.

A single visit could mean driving to Pikeville to show parents how to feed a baby with neurological damage who is unable to suck a bottle. Or, it might entail even more driving—taking a family to local agencies and helping them obtain the numerous financial and other resources required to care for and raise an infant with disabilities.

Whatever the families' needs, the two women, along with program director Jeffri Brookfield-Norman, provide vital support, knowledge and resource contacts through a one-of-a-kind children's service dubbed the Infant, Toddler and Family Program.

Rushing-Carr recalls a recent visit to a family who needed help dealing with their two-month-old daughter's physical problems. "The baby, later diagnosed as having cerebral palsy, was stiff and difficult to hold. Consequently, the parents were unable to put her in a traditional car seat and avoided traveling," Rushing-Carr says. During the first visit, she recommended a special car seat and showed the parents how to comfortably position the baby—easing the family's isolation as well as helping the baby adjust to a normal lifestyle.

While families are encouraged to set their own agendas for a visit, the program offers some structure. An assessment interview allows the caregiver to identify areas where a family may be having difficulties. Observing and videotaping interactions between family members and the infant also

help the caregiver to develop strategies with the family for reading the baby's cues and responding with appropriate behavior. The videotapes also provide a permanent teaching product. For example, recordings of how the baby is best positioned and handled by the family can be used to teach others, such as babysitters and grandparents.

"These tools help the families approach the program as a joint venture," says Brookfield-Norman, a doctoral candidate in the Department of Special Education at the University of Kentucky. "You don't want to be the expert; the parents know their babies best. The backbone of the project is the strong emphasis on having a family-focused service in the home where the babies aren't separated from their parents," she adds.

Brookfield-Norman, who wrote the grant proposal for the program, got three years of federal funding from the Handicapped Children's Early Education Program, which operates out of the Office of Special Education Programs in the U.S. Department of Education. The model demonstration project—one of only four funded nationally—works in cooperation with the Neonatal Intensive Care Unit (NICU), and the Special Well Baby Clinic at UK's Chandler Medical Center.

So far, the \$350,000 grant has been stretched to cover costs such as special equipment, travel costs and video materials. However, Brookfield-Norman says the biggest expense is paying her two associate directors to spend almost as much time driving as working with families and babies.

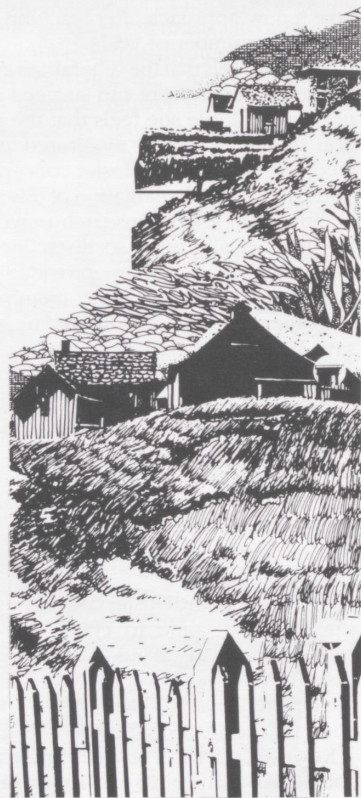
Woodson, a physical therapist specializing in pediatrics, is currently completing her master's degree in UK's Infant and Family Intervention Training Program; Rushing-Carr has an undergraduate background in early childhood development and a master's degree in occupational therapy, focusing on pediatrics. Together, the three women are pioneering a desperately needed children's service in Kentucky. "The program targets rural, Eastern Kentucky where services are either non-existent,

non-comprehensive, or only inconveniently available," says Brookfield-Norman.

Throughout the program's existence, students from UK's Department of Special Education and occupational therapy students from Eastern Kentucky University have come to the project for practicum experience. In addition to learning how to work with infants and families, the students lend a much-needed helping hand with everything from operating the videotape equipment to simply loading a car for a day of visits.

Since its beginning in August 1988, the project has served close to 20 families and their babies. ♦

—Leigh Gaines



RESEARCH BRIEFS

Mining Kentucky's Literary Talent

When Gurney Norman, UK English professor, talks about the importance of mining to Kentucky, chances are he's not talking about coal mining. "In Kentucky we have an incredibly rich literature—it's a gold mine, a motherlode, terrific raw material for drama," Norman says.

In 1986 Norman and Andy Garrison, a filmmaker at Appalshop, an arts production collective in Whitesburg, began a series of discussions about Norman's short story "Fat Monroe." When Garrison first read the story, which takes place in the mountains of eastern Kentucky, he found it "remarkable—it really spoke to me." As he and Norman discussed their perceptions of the story, Garrison decided that "Fat Monroe" would translate well into a dramatic film.

The result is the first Appalshop non-documentary film in 20 years, a 15-minute production of "Fat Monroe" directed by Garrison and shot in May of 1989 in various parts of Letcher and Perry counties. Kentucky native and longtime Appalshop friend Ned Beatty, whose film credits include

Deliverance and *The Big Easy*, stars as Fat Monroe. Norman thinks the casting of Beatty as Fat Monroe is a perfect choice. "Ned is absolutely beautiful in this role," Norman says. "He's a funny and extremely versatile actor."

For Ned Beatty, this was a homecoming of sorts. "I was born and raised in the Louisville area—St. Matthews—and was part of a touring company that did children's theater in Whitesburg in the early 60s," Beatty says. He was in the cast of *Rumpelstiltskin*, which played at that time in Whitesburg grade schools. "Fat Monroe" is a terrific story. I grew up around men like him—carpenters who would send me out for sky hooks and widgets, always testing my naivete." Beatty says that he enjoyed working with ten-year-old William Johnson who, he says, has "good impulses for 'pretend.'"

From Carbon Glow, Kentucky, Johnson was cast as Wilgus. "Here's a kid who had never acted before," Norman says, "and he was totally unintimidated. When William was being chosen, Andy asked him if he had any questions. 'I have one,' he said. 'Is it OK if I throw rocks in between takes?' What a perfect question! Andy assured him it would be fine."

The genesis for "Fat Monroe," Nor-

man says, came 28 years ago as he was driving the mountain roads near Hazard, where he grew up. "Driving through the mountains on those two-lane roads was a very productive thing for me to do," he says, "because the unchanged landscape triggered memories easily." A few months later, in the army at Fort Benning, Georgia, Norman would get off work at noon on Saturdays and check into the Ralston Hotel in Columbus, Georgia to work on his fiction. This is where he started writing "Fat Monroe."

Norman hopes that the story and the film will provoke critical thinking and stimulate good talk. "I take the view that film is useful in directing attention back to the word. The dialog in the screenplay is virtually verbatim." He adds that the video version of the film will include a 15-minute interview with him talking about the film and about Kentucky literature. Norman hopes that the 30-minute video will be useful as a classroom tool.

Norman declined to take a direct role in the writing of the screenplay, but has been active as a creative consultant throughout the production. "It was a natural role for me," he says. "I like the idea that a UK professor would participate directly in an important project for Kentucky. I saw this as a legitimate piece of service work—part of my responsibility as a UK faculty member."

Norman says the final day of shooting was an extremely moving one. "The final scene was shot about sunset after a rainy afternoon. We were surrounded by beautiful green mountains, the clouds were thinning out, and the sky was full of light. I thought back to the 24-year-old kid starting to write 'Fat Monroe' at the tiny desk in the Ralston Hotel. It was a magical moment for me." ♦



left to right: Gurney Norman, Andy Garrison, Ned Beatty

"Fat Monroe" is included in Gurney Norman's short story collection *Kinfolks*. He is also the author of a novel, *Divine Right's Trip*. Both are available from Gnomon Press, P.O. Box 475, Frankfort, KY 40602-0475.

RESEARCH BRIEFS

Tracking AIDS in Kentucky

The tangible spectre of AIDS, once thought to haunt only our biggest cities, has come to small-town America. Though 161 of the 319 Kentuckians diagnosed with AIDS since 1982 have been reported from Jefferson (125) and Fayette (35) counties (Louisville and Lexington accounting for a high percentage of these), 60 other Kentucky counties have reported AIDS cases. The Acquired Immunodeficiency Syndrome (AIDS), a complex of conditions which destroy the cellular immune system, continues to be regarded as 100 percent fatal.

"Establishing an accurate number of Kentuckians who have had, or have, AIDS is difficult," says Judy Stephenson, current site director of UK's East Central AIDS and Training Center. "The problem is, lots of people go to one of Kentucky's seven bordering states for diagnosis or treatment, so it's a problem in reporting. And some people go to several states for re-testing, hoping to find better

news."

Responding to the increasing number of reported cases in the state, William Pfeifle, assistant dean for academic affairs in the College of Allied Health Professions, and Betty Spohn, director of the Teaching Improvement Project System (TIPS) at UK, submitted a proposal in 1987 to include the university in a four-state-area AIDS consortium (the other states included are Michigan, Ohio and Tennessee). UK subsequently became part of the first four AIDS training centers funded in the U.S.

"Our role from the beginning," Pfeifle says, "has been to educate and train primary health providers to prevent and treat AIDS." He adds that though the program's focus at UK is on health professionals and not the general public, the Kentucky AIDS project does provide materials and information to the public.

"In the first three years of the project, we have collected a tremendous amount of information on AIDS," Stephenson says. "Our staff have col-

lected hundreds of reports, articles, and booklets, and they've identified many other sources that may be helpful to health care professionals and the general public."

She adds that in the past three years there has been a "proliferation" of videos on AIDS, made and sold for profit. "We've recently put together a resource guide of non-print instructional materials for health and mental health professionals," Stephenson says.

Spohn says that the second part of the project, which she calls the "Train-the-Trainer" phase, has recently begun. "In early February, UK sponsored a two-day training program for dentists and dental personnel. We distributed and discussed materials on infection control in the dental context (the use of gloves and masks, for example), and also developed a curriculum on psychosocial issues, with information on working with AIDS patients." Dentists and dental personnel from Kentucky, Indiana and West Virginia attended. Spohn says similar programs are being developed for other disciplines.

Funding for the project runs out in August of 1990, but Pfeifle says another proposal has already been submitted. "We feel we're providing an essential service. We're already seen as a clearinghouse of information across the country. And we want to keep getting that information out as quickly as possible."

For further information or materials about AIDS, contact Judy Stephenson, University of Kentucky, Medical Center Annex 3, Lexington, KY 40536-0218 (phone 606/ 257-1243). ♦



William Pfeifle, Betty Spohn, and Judy Stephenson

Space and Time Use by the Elderly Homeless

Every homeless person has a different story and a different set of problems. Some are mentally ill. Others are alcoholics. Many are just suffering the wear and tear of a harsh life. As a doctoral candidate at the University of

RESEARCH BRIEFS

Kentucky, Fay Reilly is writing her dissertation on the health problems of the homeless, especially the elderly. She believes some of the techniques of medical geography can be used to better understand these problems.

Medical geography?

"Geography is divided into two major disciplines—physical geography, which is the study of land forms and soil, and human geography, which looks at how human beings relate to this physical world," says Reilly. She explains that medical geography is a sub-discipline of human geography. "It's involved with the relationship of the environment to health, and with access to medical care. If you live a hundred miles away from the nearest medical facility that can serve you, you have to overcome that distance to get there. That's a geographic problem."

Reilly has spent the last three years studying homeless populations as a research assistant in nurse-managed clinics in Lexington. She is studying the homeless while she works toward her doctorate.

"My research involves studying their health status, and their access to health care. I'm also looking at differences in their ability to get out and about. The third thing I'm doing involves risk in their environment. Based on where people go and what they do, what does this say about the kind of health risks they're encountering?"

Reilly is particularly interested in how health problems among the elderly homeless affect their activities. "Most people, if they need to see the doctor, just call the doctor and make an appointment. Well, the elderly homeless don't, because they can't pay. This is particularly critical, because they may have more health problems, and they may not be able to manage their environment."

For the homeless, being able to manage their environment is particularly important, Reilly says. "Somebody who can walk five miles

a day and carry 25 pounds of tin cans on his back, and who can manage to get out and solve a lot of his day-to-day needs, is going to have a different pattern of activity than somebody who has, let's say, got ulcers on his feet and has a chronic lung problem." Someone who has difficulty moving from place to place may not be able to gather enough tin cans or make it to the shelter before it closes.

The differences in activity patterns can also determine which health problems and other risks a homeless person may encounter. As Reilly puts it, "Risk is not evenly distributed in space or over time." A homeless person in an urban area may have access to shelter provided by the Salvation Army in cold weather, but if the area has a high crime rate, he or she is still at risk. Similarly, a person living in a less-developed area where the crime rate is low may not have as many alternatives for shelter, and may be at risk from sleeping outside in the cold. Also, many people refuse to use a shelter because they dislike the regimented schedule, or simply because

they cannot get along with others. Another risk factor among the homeless is alcohol abuse, which cannot be monitored if the problem drinkers avoid shelters.

Reilly hopes her research will spur the use of medical geography as a framework for studying the homeless, to present a clearer picture of how they live and what they do. She believes that this new perspective will lead to new ways of dealing with the problem. "I think it's an especially important technique when you're looking at what we in nursing call 'vulnerable populations,'" Reilly says. "You get a picture of where people have been and what they've done, and the kind of opportunities they have to do the things they need to do. You can see how they're vulnerable, why they're vulnerable, and what has to happen to improve their situation."

Reilly was awarded a pre-doctoral fellowship from NIH's National Center for Nursing Research. Her project, "Time and Space Use By the Elderly," has been funded for two years by the Institute. ♦

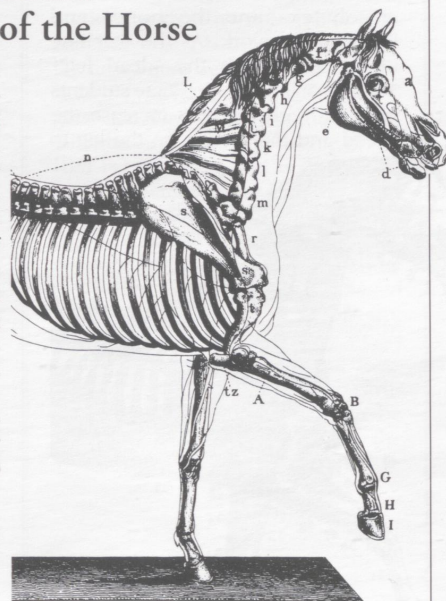
—Melinda Higgins

Sometimes a Great Motion: Biomechanical Study of the Horse

Some people bet thousands of dollars on thoroughbreds who have never run a race. Horse buyers gamble that a yearling will remain sound and run fast enough to win back the money spent at the sale. There are no guarantees, but Kent Thompson is working to take some of the gamble out of the buying risk. His study of lameness and biomechanics in the horse could lead to improved methods of treating musculo-skeletal disease, as well as the ability to predict the onset of a lameness early in the disease process.

Biomechanics is the study of motion in the body, particularly how bones and joints move in relation to each other. "We're using a high-speed treadmill and high-speed video cameras to study the way horses move in different gaits—walking, trotting, and cantering, for example,"

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Thompson explains. "The treadmill will go up to 35 miles per hour, fast enough to simulate actual racing speeds." Thompson places reflective tape on the joint and bone centers of a horse's legs and then videotapes the horse as it moves on the treadmill. The special video equipment Thompson uses enables him to produce a three-dimensional image of the horse's motion and measure the way joints and bones move in relation to each other. By studying tapes of healthy and diseased horses, Thompson hopes to find certain patterns of motion which indicate the onset of lameness.

"Another piece of equipment we use is a high-speed servo-hydraulic testing machine. This machine is commonly used in materials testing to check the endurance or strength of metals or rubber," Thompson says. He uses the machine to examine the mechanics of what is called "the dead leg." Thompson explains that over 2000 horses die in Central Kentucky each year from injury or natural causes. At the state Diagnostic Laboratory, where animals are routinely autopsied, a dead horse's leg is surgically removed so that researchers using the high-speed testing machine can closely examine the bones and ligaments at work. As the machine bends and flexes the "dead leg," Thompson and the graduate students working with him can increase the speed and the weight on the leg to

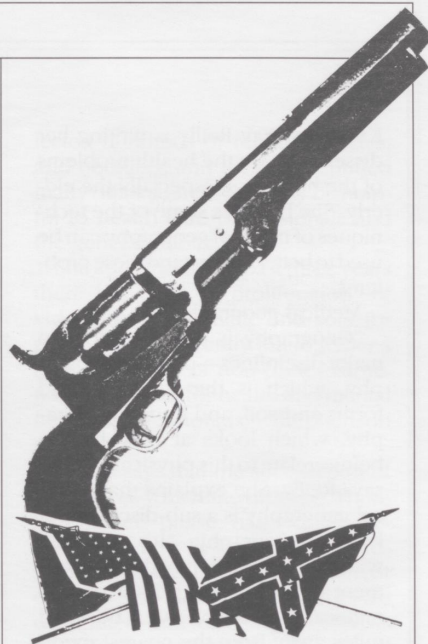
simulate the pattern of stress put on a live horse's leg. "In this way we have been able to induce bone disease in the 'dead leg,'" Thompson says, "and apply these findings to prevent bone disease in living horses."

Thompson has also been conducting research at a Central Kentucky thoroughbred horse farm, studying the kinematics (aspects of bone and muscle movement) of thoroughbred horses as they mature and begin race training. "We couldn't do this without the cooperation of the farm," he says. "We need more long-term studies like this at farms whose animals will ultimately end up racing." He hopes that as the horses develop and either become successful or unsuccessful racehorses, the video record will enable him to go back and find a correlation between certain biomechanical movements and the longevity or stress of the horse.

Should Thompson be able to do this, the ramifications for the horse industry would be considerable. Horses could be tested on a regular basis by farms, allowing abnormal biomechanical movement in a colt to be spotted and corrected, improving the horse's ability to race later in life. A test of biomechanical soundness could be required before the sale of a horse, to detect early signs of a bone disease before a buyer spends thousands of dollars on a horse who cannot race. Awareness of certain irregularities in horses experiencing the same disease could lead to a better understanding of what causes the disease, and how to prevent or cure it.

"We really won't know the quality of the data we've collected until the horses go into training and then racing," Thompson says, "but we can make recommendations as far as correcting developmental disorders."

◆
—Melinda Higgins



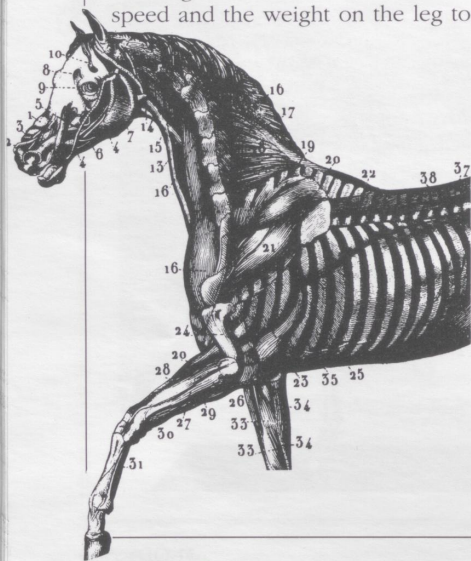
Piecing Together the Past: Excavation at Camp Nelson

Stephen McBride holds the oddly shaped piece of metal up to a picture of the ramrod of a preserved Remington pistol in one of the many books on his table. "In the Civil War most guns didn't use bullets with cartridges like they do now," he explains, "so soldiers would have to put the powder in the gun, and then the bullet after the powder, and 'push it home' as they would say. That's what this ramrod was for on the pistol, to tap the charge down."

The ramrod is one of many interesting artifacts university archaeologists have found in an excavation at Camp Nelson, which was once a Civil War depot south of Nicholasville in Jessamine County. McBride and the University of Kentucky Program for Cultural Resource Assessment were chosen to investigate the site where a new AT&T phone line will cut through the camp. The Cultural Resource Program regularly investigates areas where proposed construction may endanger archaeological sites. In this case, the excavation was funded by AT&T.

"We found this (ramrod) when we

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were doing the first shovel test, so we thought, 'this looks good,'" McBride says. The area in the path of the phone line includes three refuse dumps, where most of the artifacts were found. "Our main purpose was to look for intact deposits that were associated with the Civil War period."

McBride adds that he hopes the artifacts will teach historians more about the everyday life of the soldiers stationed at the camp. "We found a watch chain, with an old-style watch key, and there's part of a thimble. They probably had to do a lot of their own sewing," McBride is enthusiastic about the pieces assembled on the table before him, which include various buttons, a marble, and parts from an 1832 Springfield rifle. "This is a particularly exciting find," he smiles, reaching for a large oval belt buckle embossed with 'U.S.'

McBride explains that Camp Nelson was a Union quartermaster depot. Established in 1863, it also served as a convalescent camp, a recruitment center for black soldiers, and a refuge for their families. "About 40 percent of the ex-slaves that became soldiers in Kentucky passed through Camp Nelson," McBride says, "and many of the recruits brought their families partly because they were afraid of what the masters might do to them. The army initially didn't really know what to do with the families, but eventually they built what they called the 'Home for Colored Refugees' on the southwestern side of the camp."

Although the areas of the camp concerned with the refugees and the black military barracks were not in the AT&T right-of-way, McBride hopes that future work will be done at those sites. "What we have in this project is only an inkling of the many activities which took place at Camp Nelson. It would really be interesting to go back and study the site further," he says. Eating utensils, animal bones, and military objects found in those areas could answer some intriguing questions. "It would be interesting to look, archaeologically, at the refugee

camp. Did they eat food provisioned by the army? How were black soldiers provisioned?"

McBride is originally from Greenbrier County, West Virginia, and is a doctoral candidate at Michigan State University. He and his wife Kim were originally hired by the university to write a state plan for historic archaeology. The McBrides are currently working on the Lextran excavation on High Street in Lexington, and will begin work this summer on grant projects at Shakertown and Henry Clay's home at Ashland. ♦

—Melinda Higgins

Cocaine Scanning

In the war on drugs, the government may enlist a BEAST in its ranks. "To quickly analyze cocaine and its common diluting agents, we're now using a specially designed, hand-held probe in our laboratory here at UK," says Robert Lodder, of the Division of Medicinal Chemistry & Pharmaceuticals. This method used to determine if a sample contains cocaine is called the Bootstrap Error-Adjusted Single-sample Technique (BEAST); it allows the concentration of the drug to be determined inside the bottles or bags which contain the drug when it is seized.

Lodder explains that a government chemist can now analyze only eight to ten samples of a seized drug, such as cocaine, per day. A large seizure typically involves a small amount of the drug in many small containers, each of which must be analyzed before the case comes to trial. Also, Drug Enforcement Administration (DEA) laboratories routinely re-analyze seizures whenever the evidence has been out of DEA custody (as occurs when it is admitted as evidence in court). The large number of analyses that must be performed threaten the constitutional right of the defendant to a speedy trial.

"The ability to analyze the contents of the containers so quickly—in less

than one minute—will safeguard both the rights of the defendants and the government's evidence against them," Lodder says.

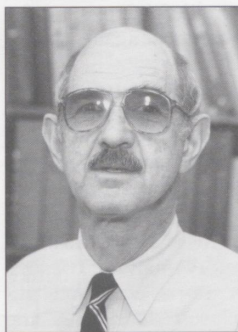
Here's how the method works. The fiber-optic reflectance probe is pointed at a sample, for example, a seized vial of white powder. The BEAST constructs a multidimensional cluster of points on a computer screen using as a base the patterns of a known sample such as laboratory-analyzed cocaine. New samples are projected into this space, and cluster differences and deviations are measured. Standard deviations can be used to determine whether the new sample matches up to the known sample.

"Our laboratory recently studied ten samples each of cocaine in three common diluting agents—lactose, mannitol and sucrose—and scanned them in both glass vials and plastic bags," Lodder says. "The IBM 3090-300E supercomputer calculated a model that produced a prediction error of 0.5 percent cocaine in vials and 0.6 percent in plastic bags, over a cocaine concentration range from 0 to 100 percent, using a single scan that took less than one minute to collect."

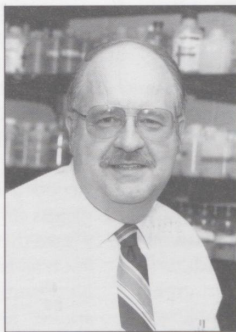
Lodder says that this current work, an outgrowth of his research at Indiana University, is made possible by the instrument designed and built by Bran + Luebbe Analyzing Technologies, Inc. The probe has the advantage, he says, of being usable on an IBM PC once a model is developed on the supercomputer. Lodder has recently submitted a \$215,000 grant proposal to the U.S. Justice Department for further funding of this study.

"The combination of the hand-held probe and the PC create a powerful portable analytical laboratory," says Lodder. "Our preliminary data demonstrate that seemingly exotic instruments like supercomputers can be quickly and efficiently applied to the solution of real-world problems." ♦

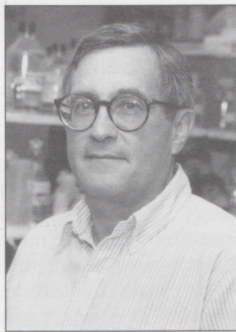
RESEARCH BRIEFS



Malcolm Siegel



Richard Barnhisel



Thomas Pirone

Three UK Researchers Receive National Awards

Three research scientists at UK recently received top national honors for their work. Malcolm Siegel, a professor of plant pathology, was made a Fellow of the American Phytopathological Society, and Thomas Pirone, also a plant pathology professor, received the Ruth Allen Award, an annual award given to the outstanding research plant pathologist. Richard Barnhisel, a researcher in soil mineralogy and land reclamation, won the top research award offered by the American Society for Surface Mining and Reclamation.

Siegel is one of approximately 40 of the 4,000 active members of the APS distinguished as Fellows. After earning his doctorate in botany at the University of Maryland, Siegel continued to study the action of fungicides. He is now trying to find controls for fescue toxicity and blue mold on tobacco. "These diseases can be very limiting to production," Siegel says, "so these areas are of extreme financial importance to farmers."

Pirone said he was recognized for his study of plant viruses and "attempting to understand how insects

transmit viruses. The payoff," he says, "is several years down the road."

Siegel and Pirone emphasize the fact that they don't do their research alone. "As my research expands, I spend less and less time in the lab," Pirone says. "So I've had a lot of good graduate students, post-docs and faculty contributing to the research."

Barnhisel won the Outstanding Reclamation Researcher of the Year Award for his ongoing research to return strip-mined land to the same level of productivity that it had before being mined. Much of Barnhisel's recent work has involved research in Western Kentucky, primarily in Muhlenberg, Hopkins and Ohio counties. His is one of three national awards offered annually by the Society, which includes members from Canada, Australia and England. ♦

Cervical Cancer Study in KY

These are the grim statistics: In 1987 approximately 12,800 women were diagnosed with invasive cervical cancer in the United States, and 6,800 died from this disease. Kentucky has the second highest mortality rate from cervical cancer for whites among the 50 states (exceeded only by neighboring West Virginia). And in a 36-county area of southeastern Kentucky, the cancer death rate for whites was 23 percent greater than for the rest of the state. The rate in this area was twice that of the rest of the nation.

Trying to reverse these alarming statistics, the Kentucky Department for Health Services and the University of Kentucky Markey Cancer Center began a joint project in 1986 supported by the Center for Disease Control. One objective was to encourage women to have regular Papanicolaou (Pap) smear tests, which can detect cervical cancer in its early stages.

The first step in this project was to determine in the 36-county area the knowledge, attitudes and practices of a sample population of women relating to gynecological medical services. Researchers were especially interested in whether the women interviewed had ever had a Pap test and, if so, how recently.

The Survey Research Center at UK was asked to direct this effort. In mid-1986 a team of women trained in survey research methods interviewed 603 women 18 years and older, randomly chosen in the high-incidence area. The face-to-face interviews typically lasted one hour. In this population-based study, 98.4 percent of the women chosen were white. "This gave us a very homogeneous population for the study," says

continued on page 35

RESEARCH BRIEFS

Angel Rubio, facilitator for the cervical cancer project. "And in focusing on white women, this study nicely complements several that have focused on non-white populations."

Overall, 91 percent of the women who had heard of the PAP test reported that they had had at least one; 70 percent had had a PAP smear within the last 3 1/2 years. Although approximately three of every four women in all age groups had made a medical visit in the past year, many women remained unscreened. Most older women who were not screened recently had not been screened regularly when they were younger.

"Results from this survey are being used to design and implement intervention strategies to increase screening with the PAP test and to reduce the number of deaths from cervical cancer," says Rubio.

A survey of physicians was also begun in 1986. Physicians in the 36-county area were asked which laboratories received their biopsy samples. A staff member of the Lucille Parker Markey Cancer Center at UK went to the labs to collect information about the number of cases diagnosed as having either dysplasia, carcinoma in situ (localized pre-invasive cancer of the cervix), or invasive cancer. Five hundred eleven women who had such diagnoses were then interviewed to determine how their medical histories, environments and lifestyles differed from those of women interviewed who did not have these symptoms. The preliminary results, according to Rubio, should be known by late fall of this year.

"The development of this registry is an important step in developing intervention strategies," says Gilbert Friedell, UK professor of pathology and director of the Cancer Control Program at the Markey Cancer Center. "This is the only population-based

registry of dysplasia in the United States," adds Friedell, who is co-PI of the project.

Meanwhile, the effort in this 36-county area to make women aware of the high mortality rate and the importance of having periodic PAP tests has been stepped up. "Various intervention strategies," says state epidemiologist Michael Moser, "will involve health departments, private physicians and community groups."

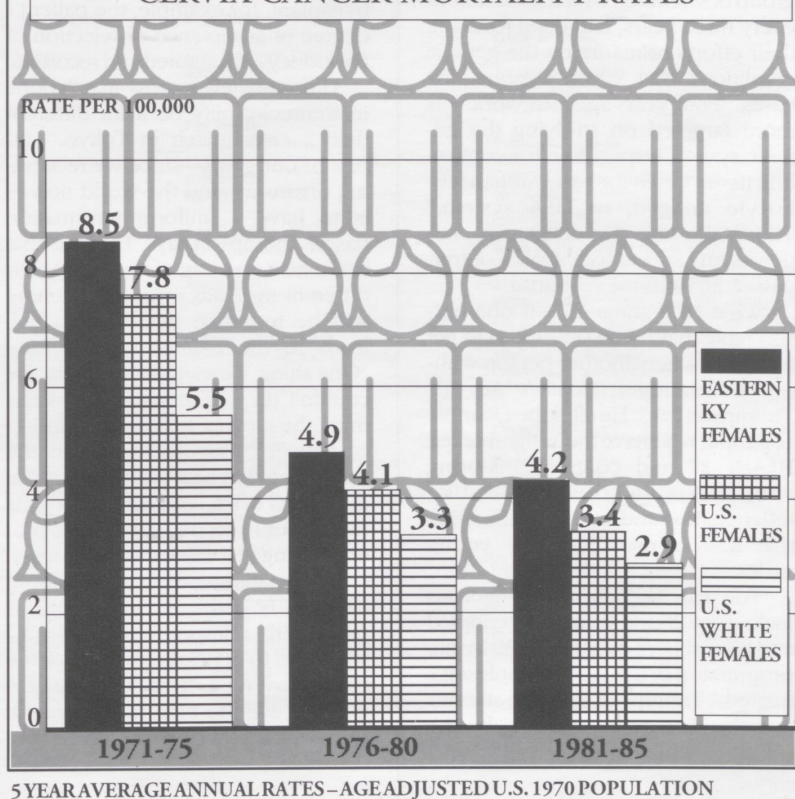
For example, all female health department patients will be given brochures on PAP tests and asked to pass the information along to friends and relatives in hopes of getting more women to come in for the tests. Also, the Department for Health Services is recruiting health departments and private physicians to send

patients reminders that they are due for a PAP test. And women belonging to homemaker, civic and church groups will be asked to refer friends and family members to health departments or physicians for the examination.

"Women should not die of cervical cancer," says Health Commissioner Carlos Hernandez. "If caught early enough, it is almost always curable."

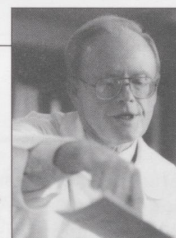


U.S. COMPARED TO EASTERN KY (1971-85) CERVIX CANCER MORTALITY RATES



RESEARCH

Results



John Thompson

Data Bank Accruing Worldwide Interest

For the past 25 years, John Thompson and a group of scientists from around the world have been meeting to pool information on a human genetic system critical to organ transplants and to the understanding of a variety of diseases.

"It's an unusual level of international cooperation," says Thompson, chairman of the Department of Medicine at the University of Kentucky. "The project involves lots of sharing," he adds. "You have to agree to give up data you've gathered for the greater good."

When this project was first featured in the Spring 1986 *ODYSSEY*, the group of scientists, which meets about every three years, had been focusing their efforts primarily on the genetic conditions that cause various diseases. "Four years ago, our work was more targeted on studying the genetic system responsible for controlling tissue behavior—the human leukocyte antigen, or HLA system," Thompson says. He defines an antigen as any substance capable of triggering an immune response.

"What HLA antigen does one person have that predisposes him to get a disease when another person without that antigen doesn't get it?" Thompson asks. He cites the example of people who have the antigen called HLA-B 27 and contract ankylosing spondylitis, a rheumatoid-like inflammation and arthritis of the spine that affects predominantly young males.

"You can be a healthy, vigorous male at age 20 and be severely crippled and almost bent over at age 30 by the progression of this disorder unless it's treated," Thompson says. He stresses that the disease isn't caused by the

antigen, but by its altering of the immune system.

Though the international group continues to study the HLA system, they have shifted their focus in the past four years, Thompson says, to clinical organ transplantation. "We've been doing a lot of work recently on the problems of 'cross-matching.'" He explains that this consideration is the final test of whether or not a patient gets a kidney or other organ from a donor. A cross-match involves analyzing the potential immune reaction by the patient to the donor organ. A high risk of graft failure arises when the test is positive. "For every transplant patient, we get donor spleen cells which we type to get the best match we can," Thompson says. After the operation is done, a kidney transplant, for example, the patient's degree of acceptance or rejection of the kidney is monitored and recorded.

"Unfortunately, a cross-match done in Kentucky may be a lot different than a cross-match in Tokyo. And one of our goals—since we're sending organs around the world now—is to have a uniform information base," Thompson says. He adds that at the next meeting of the group four different methods of cross-matching will be tested to determine which leads to the highest success rate. "One thing we can do now that we couldn't do four years ago is determine the type of genes of the group of antigens that interfere with the transplantation process. Typing at the gene level using molecular biology is much more precise than typing proteins using serological techniques."

Another disease the researchers are tackling is diabetes. This work is particularly relevant to Kentuckians, who tend to get diabetes at twice the national average. "The incidence here is about eight to nine percent of the population," Thompson says. "The

type of diabetes that usually starts in youth correlates, again, with the HLA system. If you have something called HLA DR-3 and 4—say you have both of these—the chances of you getting Type 1 diabetes, the type that tends to affect younger people, are about 50 times greater than if you didn't have these particular antigens." By using the data on gene typing of these antigens, Thompson says, people who are at risk for diabetes can be identified, and perhaps the onset of the disease can be prevented.

Thompson is eagerly anticipating the group's next meeting, which will be held in Japan in 1991. He says that since its founding by Nobel Prize-winning scientist Jean Dausett and a few others, the program has grown from a group of four labs contributing to the genetic data bank to over 140. "Players are coming in from all over the world," he says. "Every West European country is represented as well as Brazil, Venezuela, Mexico, Japan, China, Taiwan, New Zealand, Singapore, Australia, South Africa and Canada."

And by next year, when these individuals gather to share their most recent data and insights, Thompson believes they may have some new recruits as a result of the changing political system in Eastern Europe. "The most logical country to join the group effort would be Czechoslovakia, since it's had a strong immunology program for over 30 years."

"If I could do the work by myself, which I can't, it would take me a lifetime to obtain the data the group has collected now. As it's shaping up, next year there will be about five or six projects with plenty of people working on each one. The most important result will be that, again, we'll collect a huge amount of information that everyone will have access to." ♦

—Jeff Worley

DIRECTORY

University of Kentucky
Lexington, Kentucky

Addresses of UK faculty,
staff and students featured
in this issue of *ODYSSEY*

Area code is (606)

Hussain Aleem
Biological Sciences
101 Morgan Biological Sciences
Building
40506-02251
Ph. 257-4630

Richard Barnhisel
Agronomy
N122 Agriculture Science Center
North
40506-00914
Ph. 257-8627

David Berry
Psychology
12D Kastle Hall
40506-00442
Ph. 257-5451

Maria Bertero
Reproductive Medicine
Dept. OBGYN C-312
Chandler Medical Center
40506-0840
Ph. 233-5410

Dibakar Bhattacharyya
Chemical Engineering
773A Anderson Hall (Tower)
40506-00461
Ph. 257-2794

Joan Blythe
English
1225 Patterson Office Tower
40506-00276
Ph. 257-7009

Yvette R. Cook
Neurology
MS129 Chandler Medical Center
40536-00840
Ph. 233-5664

Nirmala S. Desai
Pediatrics
MS469 Chandler Medical Center
40536-00843
Ph. 233-5530

James Dinger
Kentucky Geological Survey
302 Mining & Mineral Resources
Building
40506-01071
Ph. 273-6701

Gilbert Friedell
Markey Cancer Center
CC140 Markey Cancer Center
40506-00931
Ph. 257-4500

Robin L. Gilmore
Neurology
MS109 Chandler Medical Center
40536-00840
Ph. 233-5663

Christine Havice
Art
201A Fine Arts Building
40506-0224
Ph. 257-1716

Kevin Hopper
1038 Whitehall Place
Lexington, KY 40502

Gerald Huffman
Institute for Mining & Minerals
Research
233 Mining & Mineral Resources
Building
40506-01071
Ph. 257-4029

Frank Huggins
Institute for Mining and Minerals
Research
208 Funkhouser Building
40506-01071
Ph. 257-4045

Richard Kermod
Chemical Engineering
153 Anderson Hall (Tower)
40506-00461
Ph. 257-2823

Robert Lodder
College of Pharmacy
441 College of Pharmacy Building
40536-00821
Ph. 257-9232

Ed Lyon
Dentistry-OHP-Prosthodontics
A235 University Medical Plaza
40536-0223
Ph. 233-6714

Geraldine Maschio
Theatre
111 Fine Arts Building
40506-00222
Ph. 257-1385

Stephen McBride
Cultural Resource Assessment
101 American Building
40506-0100
Ph. 257-1944

Gurney Norman
English
1257 Patterson Office Tower
40506-00276
Ph. 257-1154

Jeffri Brookfield-Norman
Human Development Program
210A Porter Building
40506-02051
Ph. 257-8281

Nancy Pedigo
Center for Reproductive Medicine
C312 Chandler Medical Center
40536-00840
Ph. 233-6433

William Pfeifle
Health Services
100A Medical Center Annex 3
763 Rose Street
40506-02181
Ph. 257-5417

Barbara A. Phillips
Pulmonary Medicine
MN576 Chandler Medical Center
40536-00847
Ph. 233-5419

Thomas Pirone
Plant Pathology
S321F Agriculture Science Center North
40506-00917
Ph. 257-2759

Karl Raitz
Geography
1465 Patterson Office Tower
40506-00270
Ph. 257-6948

Fay Reilly
College of Nursing
15 College Of Nursing/HSLC
40506-0232
Ph. 233-6533

Angel Rubio
Kentucky Cancer Program
170 Markey Cancer Center
40506-00931
Ph. 257-5459

Carol Rushing-Carr
Human Development Institute
12 Porter Building
40506-02051
Ph. 257-4771

Lyle Sendlein
Geology/Institute for Mining and
Minerals Research
233 Mining and Mineral Resources
Building
40506-00592
Ph. 257-6232

Naresh Shah
Institute for Mining & Minerals
Research
208 Funkhouser Building
40506-01071
Ph. 257-4045

Kathy Sharpe
Obstetrics & Gynecology
MS335 Chandler Medical Center
40536-00848
Ph. 233-5123

Malcolm Siegel
Plant Pathology
S305F Agriculture Science Center North
40506-0091
Ph. 257-2889

Betty Spohn
Administrative Services
104 Medical Center Annex 3
763 Rose Street
40506-02181
Ph. 257-5413

Judy Stephenson
Administrative Services
1 Medical Center Annex 3
763 Rose Street
40506-02181
Ph. 257-1243

Kumble Subbaswamy
Physics & Astronomy
395 Chemistry-Physics Building
40506-00552
Ph. 257-1997

Louis J. Swift
Academic Affairs/Classics
7 Administration Building
40506-00320
Ph. 257-3027

John Thompson
Pulmonary Medicine
MN579 Chandler Medical Center
40536-00840
Ph. 233-5419

Kent Thompson
Veterinary Science
123 M.H. Gluck Equine Research Center
40506-00990
Ph. 257-4177

Michael W. Vernon
Obstetrics & Gynecology
MS335 Chandler Medical Center
40536-00848
Ph. 233-5110

Richard Warner
Agriculture Engineering
108 Agriculture Engineering Building
40506-00751
Ph. 257-7381

Cheri Woodson
Human Development Institute
144 Mineral Industries Building
40506-0051
Ph. 257-4771

ODYSSEY

Research Communications Office
Vice President for Research and Graduate Studies
Fourth Floor, Kinkead Hall
University of Kentucky
Lexington, Kentucky 40506-0057

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