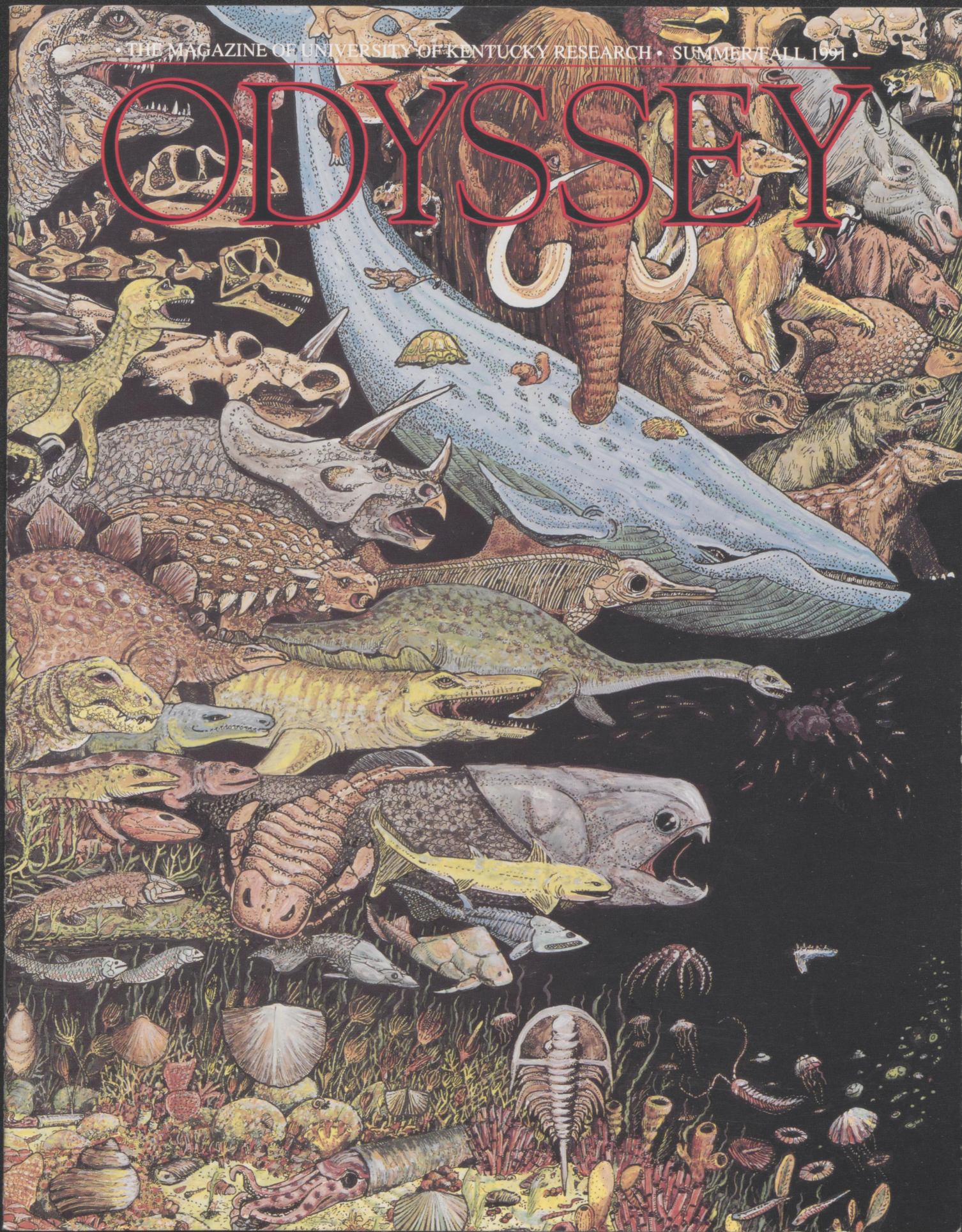
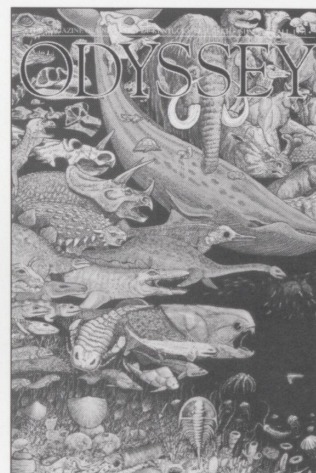


THE MAGAZINE OF UNIVERSITY OF KENTUCKY RESEARCH • SUMMER/FALL 1991 •

ODYSSEY





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

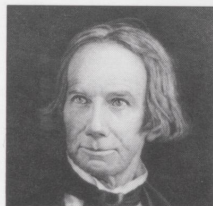
With this mission as its premise, one goal of the university is to conduct programs of basic and applied research which support graduate and professional education, provide for the advancement of knowledge, and seek solutions for the acute problems of society.

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

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

ODYSSEY

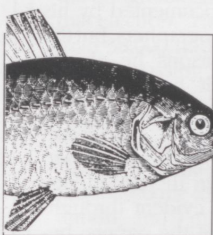
Volume IX, No. 1



Clay Project Complete, p. 2



Robot to the Rescue? p. 10



Fishy Behavior, p. 14

CONTENTS

Clay Papers Project Completes Its Final Chapter	2
Fighting Fire with Technology: A Robot to the Rescue?	10
Fishy Behavior	14
Honorable Mention: Conserving Culture through Anthropology	18
Behind the Scenes: Teaming Up against Infertility	20
KIOSK	22
Update: Tuska: "One Life Is Not Enough"	27

University Archives
Margaret I. King Library - North
University of Kentucky
Lexington, Kentucky 40506

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

Requests for permission to reprint material and readers' comments regarding ODYSSEY are welcome and should be sent to the Editor, Communications and Advancement, Office of the Vice President for Research and Graduate Studies, University of Kentucky, Lexington 40506-0057 (phone 606/257-8297).

The publication of ODYSSEY is not financed by state-appropriated funds.

Editor: Susan H. Hodgetts. Assoc. Editor: Jeff Worley. Designer: Shear & Shear. Publications Asst.: Lisa D. Lizer. Research Asst.: Melinda Higgins. Contributing Writers: Elizabeth Hansen, Leigh Gaines, Suzanne Froelich. Printing: Merrick Printing, Inc.

Credits: cover illustration, "Progression of Life," by Stephen Greb; photos on pp. 5, 10, 11, 12, 13, 15, 20, 25, 27 by Ken Goad; photos on pp. 7 and 24 by Lee Thomas.

University Archives
Margaret I. King Library - North
University of Kentucky
Lexington, Kentucky 40506

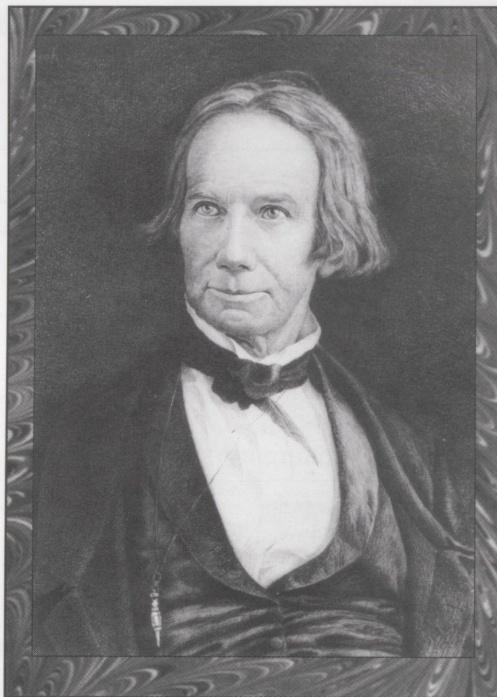
Received in campus mail (May?), 1991

Clay Papers Project Completes Its Final Chapter

by Elizabeth Hansen

Forty years ago historians at the University of Kentucky set out to gather and publish the public and private papers of Henry Clay, probably Kentucky's most famous historical figure and a major national politician during the first half of the 19th century. Over the years, four historians have served as editor of the papers, which have been published in chronological order in 10 volumes—some of them more than 1,000 pages long. The tenth volume was issued this spring. The eleventh and final volume, which contains documents found too late to be included in the chronology, is almost complete; the project officially ends June 30, 1991.

The volumes titled *The Papers of Henry Clay* are usually thought of as a tool for researching political history. The documents fully exhibit Clay's career as Speaker of the U.S. House of Representatives, peace negotiator for the Treaty of Ghent, secretary of state, U.S. senator, and leader in three sectional compromises designed to save the Union. But the documents—particularly the letters—are fascinating for what they reveal about the tragedies in Clay's public and private life.



*An engraving of Henry Clay, 1847
(by J. Reich, UK Special Collections)*

Clay's public tragedy—his failure to win the presidency of the United States despite five attempts—has been documented by his biographers, but the reasons he always felt he could win have not been. Clay's optimism about his chances to win the presidency is evident throughout the papers, beginning before his

first candidacy in the election of 1824, according to Melba Porter Hay, the current editor and director of the papers project.

"Anyone who has studied Clay knows that he was always extremely optimistic about his chances to win the presidency. He had to be to keep going all that time," Hay says. "I don't think any biographies of him up to this point (the publication of volume 10 of his papers) have adequately explained how he could keep convincing himself that he had a chance to win."

In volume 10 are a number of letters from politicians across the country urging Clay to run for the presidency again in 1848 and promising him support. One particularly strong letter was from William Bebb, governor of Ohio, offering Clay his support and Ohio's backing at the Whig Party's national convention.

"When they got to the convention, Ohio did not go for Clay," Hay says. "It [the Bebb letter] shows he had all these people telling him things from other states. He had no Gallup Poll. He had to go by what he was being told. He was easy to convince, but he was always being told, 'This time is different; you can win.'"

Clay's ambition also kept him running for president. According to Robert Seager II, who preceded Hay as editor, Clay "had an ambition that was almost a sickness." He thinks Clay may have been misled about his chances because he corresponded with "second- and third-level people," not the "wheelers and dealers" outside of Congress. "He had a group of flacks who fed him pretty much what he wanted to hear," Seager says.

Clay lost the popular vote in the 1844 election by 38,000 votes. "And we know from the Congressional investigation conducted after that election," Hay says, "that there were more than 38,000 fraudulent votes cast."

In discussing his election losses in his letters, Clay was much more open about his feelings when writing to women than to men. Writing about his defeat to other men, Clay "said things like 'It's probably a good thing,' 'it's spared me a lot of anguish, work and frustration,' and 'I'm probably better off to retire at Ashland and be happy,'" Hay says. But in a letter to Mary S. Bayard, wife of a Delaware senator, Clay appeared much less reconciled to the loss. He wrote: "I will not disguise, my dear friend, that I felt the severity of that blow, more perhaps because two weeks ago it was altogether unexpected by me here."

Bayard was one of several women Clay corresponded with regularly. Others were Eliza Johnston, wife of Clay's good friend Josiah Stoddard Johnston of Louisiana, and Octavia Walton LeVert, a Southern belle from Mobile, Alabama, who was apparently very taken with Clay when he was in his sixties and seventies, according to Hay. The papers in-

Letter from Henry Clay to his son Thomas

Washington
My Dear Son

I wrote to Mary
I should desire you to come on to
to be with me. I have received
that letter owing perhaps to the
in the regular arrival of the
wish that you would leave home
10th or 12th of May and join
the National Hotel.

My desire is to go home toward
May or early in June if I can
strength to take me there and

The documents—particularly the letters—are fascinating for what they reveal about the tragedies in Clay's public and private life.

...ile be the case,
there is a crisis
the vilest spring
There has not been
I could drive out with safety.

Hopes are entertained that
gets better I may be benefited by
some exercise. There has been no
in my condition for months except
weaker & weaker

continued on page 4

Clay Paper Project Completes Its First Chapter



James F. Hopkins, the first editor of the Clay Papers, and his successor Mary W.M. Hargreaves in 1957

“I feel that one of the strongest ties that bound me to Earth is broken— forever broken. My heart will bleed as long as it palpitates. Never, never can its wounds be healed.”

clude about a dozen letters exchanged between Clay and LeVert in which they discussed such things as politics and their children. They often made arrangements to see each other when Clay went to New Orleans for the winter.

Clay's friendships and correspondence with women contributed to his reputation as a womanizer, but none of the editors of his papers has found any evidence that Clay was unfaithful to his wife, Lucretia. "He was very attentive to the ladies, but we found no evidence that he was promiscuous," says James F. Hopkins, the first editor. His successor, Mary W.M. Hargreaves, who describes Clay as "a dazzling personality," says, "We

never found anything that went beyond gallantry—gallantry and courtliness."

Historians know very little about Clay's wife, Lucretia, whom Hay describes as "the shadiest figure" in the Clay papers and Seager characterizes as "an absolutely zero figure—she's just not there."

"She did not write letters," Hay says. "We have one letter and it's a copy. He [Clay] said in a number of letters that she didn't write, that she didn't like to write. We don't know why. We don't really get a very good picture of her at all. Clay wrote to her a lot and he wrote about her, but even then you just don't get a very good feel for what she was like. You get a much better feel for his children."

Because Clay was often in Washington while his family remained in Kentucky, the papers contain hundreds of family letters. Clay wrote one of the most poignant letters in the collection to Lucretia on December 19, 1835, the day after he learned that his favorite daughter, Anne Brown Clay Erwin, had died at the age of 28 following the birth of her fifth child. Anne was the last of Clay's six daughters to die. Clay wrote:

"Alas! my dear wife, the great Destroyer has come, and taken from us our dear, dear, only daughter! . . .

"If the thunderbolt of Heaven had fallen on me—unprepared as I fear I am—I would have submitted, cheerfully submitted, to a thousand deaths to have saved this dear child. She was so good, so loving, so beloved, so happy, and so deserving to be happy. Then, she was the last of six dear daughters, most of them at periods of the greatest interest and hope, taken from us. Ah! how inscrutable are the ways of providence!

"I feel that one of the strongest ties that bound me to Earth is broken— forever broken. My heart will bleed as long as it palpitates. Never, never can its wounds be healed.

"I know, my dear wife, my duty, but how difficult is it to restrain the sorrows of a broken heart? I know submission to the Will of God is my duty. I have not to sustain me the religious resource which you have, and I regret it; but reason tells me what is my duty. . .

"My dear, I ought to endeavor to comfort you, and I am shewing my weakness. I cannot help it. This dear child was so entwined around my heart; I looked forward to so many days of comfort and happiness in her company, during the remnant of my life, that I shall never, never be able to forget her. My tears, and thank God they have flowed almost in a continued stream, have been my only relief. Sleep, food, I have scarcely tasted either. . . ."

Most of the tragedies in Clay's private life, the deaths of his daughters, for example, involved his children.

While it is generally known that Clay's eldest son, Theodore, spent much of his life in the Lunatic Asylum of Kentucky (now Eastern State Hospital), few people know that another son, John, also spent time there. Letters documenting John's confinement were published this spring in volume 10.

(According to Hay, when she became editor she was told there were restrictions on the letters about John's mental illness and that they could not be shown to anyone until they were published in the chronology. Because John was first committed to the asylum in 1845, only seven years before his father's death, the letters were not scheduled for publication until volume 10. Hay and Seager say they do not know the origin of the restrictions, but Hargreaves says she knows. "We cooked it up. We were afraid," she says. The letters had come originally from the Library of Congress collection and Hargreaves had found them in the 1950s. Because letters are the property of the correspondents and their descendants, Hargreaves feared someone would try to stop publication of negative material about the family. "We didn't want to make a great sensation about the misfortunes of Clay's children. . . . We did not want to sensationalize it," she says.)

John was hospitalized less than a month but was in and out on other occasions. During the last years of his life, Clay worried constantly that John was going to become like Theodore, Hay says. After his father's death, John married his nephew's widow and became a well-



Melba Porter Hay



Robert Seager II

continued on page 8

The Origins of the Clay Papers



*An engraving of Henry Clay, 1852
(by A.H. Ritchie, UK Special Collections)*

The Papers of Henry Clay was one of several historical papers projects begun in the United States in the early 1950s. The chairman of the University of Kentucky's history department, Thomas Clark, recruited James F. Hopkins to edit the Clay papers and Mary W.M. Hargreaves to be the associate editor. Although conceived in 1950, the project didn't get underway until 1952.

"For a country boy who had never done much work of that sort (editing historical papers), I had an awful lot to learn. It was fun," recalls Hopkins, now 82. "It was also an awful lot of work."

Hopkins traveled to libraries to gather Clay materials on microfilm or photostats. Because photostats cost 50 cents a page in those days and microfilm about four cents, most of the letters came in on microfilm and then had to be typed. Hargreaves did much of the typing herself at first, including most of the Library of Congress file of Clay's papers.

Early financial support came from Barry Bingham, Sr. of Louisville, Guy Huguelet of Lexington, The Lilly Endowment of Indianapolis, the University of Kentucky Research Fund, and the University of Kentucky Press (now the University Press of Kentucky), the publisher of the papers. Since the late 1960s the project has been funded by yearly grants from the National Historical Publications and Records Commission. Last year the National Endowment for the Humanities provided a \$35,000 grant to complete the project.

"I don't think anybody really understood in the fifties when these projects got underway exactly how much was entailed, how many docu-

ments they were going to find, how many would keep appearing over the years," says Melba Porter Hay, who became editor and director of the project in 1987.

The original objective of the project was "to collect as completely as we could photocopies of letters written by Clay, letters written to him, his speeches, other writings of which he was the author and significant items about him," Hopkins says.

The first volume was published in 1959 after seven years of research, compilation and editing. It covers the years 1797 through 1814 and is 1,030 pages long. A newspaper article at the time predicted that the remaining nine volumes would be published at the rate of about two per year and that the total cost of the project would be \$200,000. Both predictions were far from accurate. Hay doesn't know what the project has cost, but "it's a lot more than that," she says.

The second and third volumes appeared in 1961 and 1963 and took Clay through the War of 1812, his tenure as Speaker of the U.S. House of Representatives, and his first presidential candidacy in 1824. The project hit a slowdown when it reached Clay's years as secretary of state from 1825 to 1829 because of the sheer volume of documents. The original plan was to include Clay's four years as secretary of state in one volume; instead, a volume was devoted to each year. Nine years elapsed between the publication of volume 3 and the appearance of volume 4 in 1972. Volume 5 followed a year later.

After Hopkins had a heart attack in

the early 1970s and retired in 1974, he became a part-time consultant for the project. Hargreaves became editor and project director, a position she held until her retirement in 1979. Volume 6, the last produced by Hargreaves and Hopkins, was published two years after Hargreaves' retirement. It covers Clay's third year as secretary of state and is 1,448 pages long.

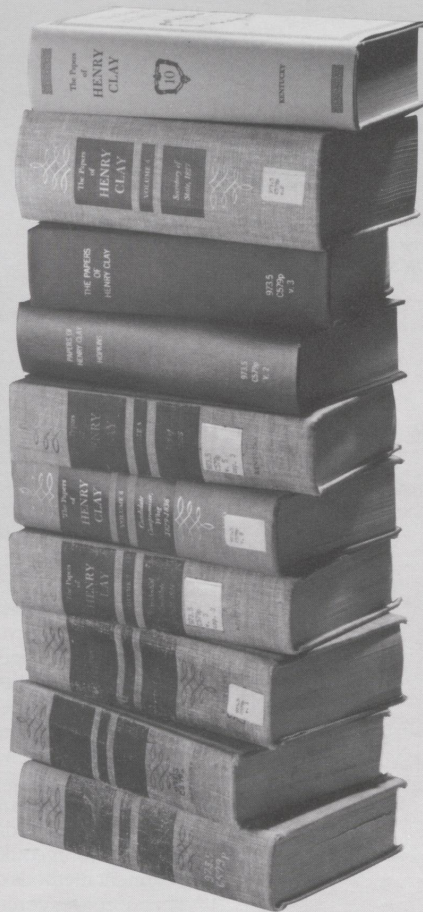
In 1977 Robert Seager II joined the project and became director and editor in 1979. With volume 7, the first Seager edited, the project took a basic turn in philosophy. Rather than attempting to include every document, a decision was made to compress by listing routine documents in a calendar at the end and reducing the scope of the footnotes. "If we hadn't done that, we still wouldn't be finishing up," says Hay, who joined the project in 1980.

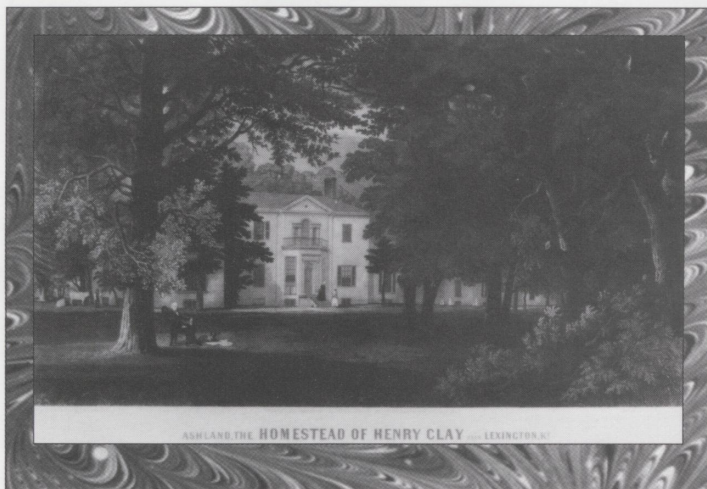
Seager directed the publication of volumes 7 (1982), 8 (1984), and 9 (1987) before retiring in 1987. Volume 7 covers Clay's last year as secretary of state, volume 8 the years 1829-1836 when Clay was a presidential candidate, compromiser and Whig Party leader, and volume 9 the years 1837-1843 when Clay was again a presidential candidate and leader of the Whig Party.

Hay succeeded Seager as editor of volume 10 (1844-1852) and of volume 11, a supplement which contains over 1,000 letters discovered too late for publication in chronological order, an errata of mistakes found in the other volumes, a comprehensive bibliography, a calendar of minor documents, and a calendar and essay about artwork done of Clay prepared by retired University of Kentucky art

professor Clifford Amyx. The supplement is expected to be published in late 1991 or early 1992.

A celebration is planned June 21-22 to mark the conclusion of *The Papers of Henry Clay* project. It will feature a banquet, a symposium, a reception at Ashland and an exhibit of Clay memorabilia prepared by UK Library Special Collections and Collection Development departments.





*Ashland, Clay's home,
circa 1910
(UK Special Collections)*

known horse breeder.

Theodore did not improve after he was hospitalized. In a June 1832 letter to his father, Henry Clay, Jr. described the diagnosis and treatment recommended by Theodore's physician:

"Theodore is deranged upon two subjects, love [Theodore had developed a fixation on a woman] and ambition. The first can only be cured by time, the second by humiliation. By humiliation he [Theodore's physician] means that Theodore should be treated by all as an ordinary young man incapable of self direction. That no particular deference should be paid to his opinion or judgment however much we may attend to his personal comfort; it should not appear. That no indulgences should be made the evidences of any particular respect. In fine that we should appear entirely indifferent to his opinion or his mind."

The family also was told it was a mistake to send Theodore his political periodicals "as it would evince regard for his opinions."

"No wonder he didn't get better," Hay says. Hay says John could have improved because treatment methods changed between the time Theodore was committed and John's confinement. Hargreaves questions whether there was ever anything wrong with John other than his being a bit unstable. The family may have

been paranoid because of Theodore, she says.

Clay's favorite son was Henry Clay, Jr., who is described by both Hopkins and Hargreaves as "the apple of his father's eye." According to Hay, young Henry was supposed to be the most promising of Clay's five sons, but that promise never materialized. "He had graduated second in his class at West Point, but other than that, he never really did anything," Hay says.

Although trained as a lawyer, Henry, Jr. was not practicing law when the Mexican War began. He enlisted in the army and served under Gen. Zachary Taylor in Mexico. Henry, Jr. was killed Feb. 23, 1847 at the Battle of Buena Vista. Among the Clay papers are a letter Henry, Jr. wrote to his father a few days before being killed, a letter from Taylor telling Clay of his son's death, and a letter from Clay to William N. Mercer:

"I find it extremely difficult to sustain myself under this heavy calamity. I was greatly attached to him, and he had high qualities, well-known to me, entitling him to my warmest affection. How often, my dear friend, are the objects most endeared to us snatched away from us! Such has been my sad experience throughout life."

Henry, Jr. "never really did anything with his life except give it in the war," Hargreaves says. "It was almost like a chance to redeem himself."

All of Clay's children had financial problems except for John, who lived at home, Hay says.

Thomas was in constant financial trouble, she says. "He had at least one business that went broke, a hemp factory making bagging and rope, and Clay took the fall for that," Hay says. Thomas' business failures almost caused Clay to lose Ashland just after he had been defeated in the 1844 election. A number of Clay's friends from around the country anonymously paid about \$35,000 of his mortgage, which enabled him to keep Ashland. Clay purchased Mansfield, a farm adjacent to Ashland, for Thomas to live on, but when he

died, Clay left Mansfield in trust to Thomas' children.

In Hay's view, James was the most successful of Clay's children. A lawyer, James served as charge d'affaires to Portugal during the Fillmore administration. He bought Ashland after his father's death and rebuilt the house. He later became a Confederate and died of tuberculosis in Canada during the Civil War.

Even on his deathbed Clay was dealing with his sons' financial difficulties. Clay went to Washington in the spring of 1852 to argue two cases before the Supreme Court because he needed money, even though he knew he might not live to get back home to Ashland. He was unable to argue the cases himself, but he got other people to do so for him and Clay split the fees with them. "Money was the reason Clay went back [to Washington]," Hay says. "He really wanted to get home to die, but he just wasn't able."

On April 28, 1852, Clay wrote to James telling him he had endorsed a \$4,000 note for him. In that letter he also wrote: "My health continues precarious and extremely critical. Unless there is a favorable change soon, I cannot hold out much longer. I have sent for Thomas." His son Thomas was with Clay in Washington when he died there on June 29, 1852.

Clay's problems with his children were similar to those Daniel Webster and John C. Calhoun had with their children. The children of all three men may have had difficulty living up to the reputations of their famous fathers, Hay and Hargreaves say. Clay, Webster and Calhoun were all senators in the first half of the 19th century and are considered by many historians to be the most important political figures in the period from the War of 1812 to the Civil War other than Andrew Jackson, who was on the opposite end of the political spectrum from Clay and Webster. Like Clay, Webster and Calhoun have been the subjects of historical papers projects.

Did Clay deserve to have 40 years devoted to the compilation and editing of his papers? Hay thinks so. "Clay was a much more significant figure than all those nonentities that became president during that time. How many people can remember a president between Jackson and Lincoln?" ♦

“Clay was a much more significant figure than all those nonentities that became president during that time. How many people can remember a president between Jackson and Lincoln?”



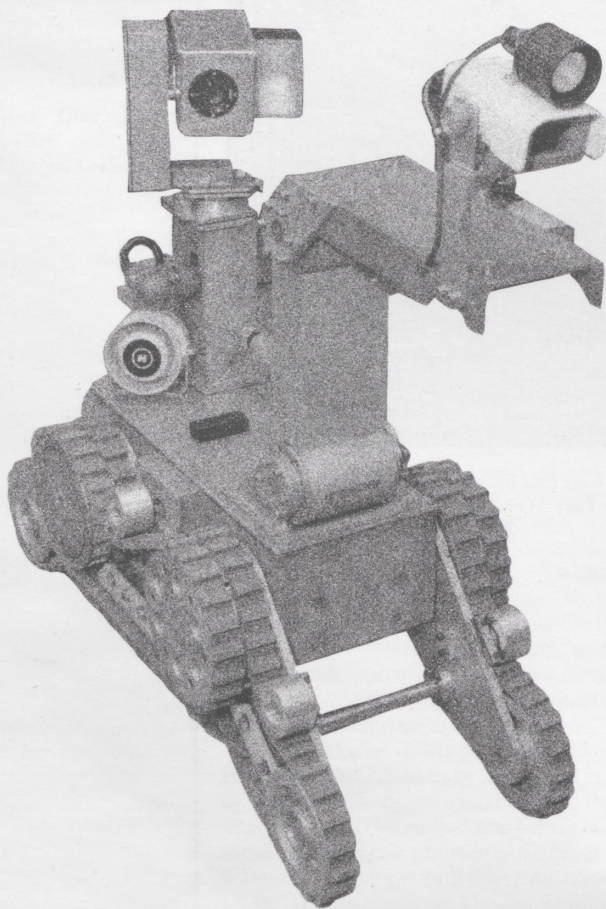
*Henry Clay and his wife Lucretia
(Henry Clay Memorial Foundation)*

Fighting Fire with Technology: A Robot to the Rescue?

by Jeff Worley

On the wall of Kozo Saito's office is a large photograph of Albert Einstein. The old physicist is balancing himself in a sailboat, his white shirt billowing out and his hair a wild drift of snow.

Saito, an associate professor of mechanical engineering, gestures toward the photo. "Yes, he's a hero of mine, but not so much for his mathematical theories." Saito's face eases into a smile. "It's Einstein's *philosophy* that interests me more," he says, "his belief that science should improve people's lives."



And Saito, in continuing a research project at the University of Kentucky on fire detection and spread, is proving to be an able practitioner of this philosophy. The result of his work may not only improve people's lives, it may save lives.

Funded by the National Institute of Standards and Technology's Center for Fire Research, Saito has been working with several researchers at UK's Center for Robotics and Manufacturing Systems to develop a fire-fighting robot. "We have in the building right now a functional, mobile robot," says William Gruver, director of the center and co-principal investigator on this project. "It can be guided remotely to enter rooms, climb stairs, and even crawl over beams and debris."

With its manipulator arm extended and its three separate sets of track treads moving over the wheels' high-tech pulley system, the robot resembles a miniature tank. Attached to the arm (capable of pivoting in two motions) is a gripper with two "fingers" that can be continuously rotated in clockwise and counterclockwise directions. The fingers can be manipulated to squeeze together and clutch an object. Weather-resistant housing rises from the plate of the robot, and at the top of this housing is a spotlight and a color TV camera with a zoom lens.

A cable, 328 feet long, runs from the back of the robot to a command console, the idea being that in a hazardous situation the operator can control the robot from a remote location. The switchbox functions on the console include 23 options which allow an operator to move the robot forwards and backwards, lift the various tracks, operate the spotlight and camera, and move various other components. Gruver refers to this process as "tele-operation" or "tele-robotics."

In order to turn this model into an effective fire-fighting machine, there are some "hardware problems," as Gruver calls them, that must be solved. "This model has rubber treads, for example," he points out. "And they would fry in a burning building." So some engineering modifications will need to be made, perhaps retrofitting the robot with metal treads and using high-pressure water spray to cool

them. Such design problems, Saito and Gruver agree, are relatively minor. What they term "conceptual problems" are far more challenging.

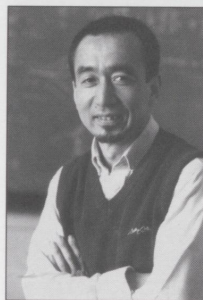
For this firefighter to be propelled from the world of science fiction into the realm of science fact, according to Rajiv Mehrotra, it will need to be endowed with "local intelligence" (the result of decision-making software) and a guidance device so that it knows where it is. Mehrotra, a professor of computer science whose expertise includes the development of the robot's vision system, imagines a robot capable of moving and opening doors on instruction. "We'll probably do our first tests of this capability in this building," he says.

An essential part of the robot's intelligence system will be its ability, after entering a burning building, to decide where the hottest part of a fire is located. This is where Saito's work comes in. "I've been doing research since 1984 to mathematically calculate upward flame spread along the corner of a wall so that a robot will be able to intelligently combat a fire," says Saito. Through an infrared camera system mounted onto the robot, it will be able to look through a flame and see behind it by using filters; then the robot, using a "profile" of the burning wall, can shoot the hottest spot with a directed jet of water or chemical, says Gruver.

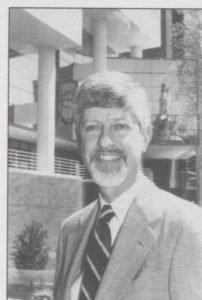
In order to obtain a profile or, as Saito puts it, do some "temperature mapping," data are gathered from an artificially created and contained fire in UK's Combustion and Fire Research Laboratory. Toward the back of this lab is a structure capped with a galvanized metal hood. The space underneath, about the size of an average closet, has one open side, two solid walls, and a wire-mesh screen forming a final "wall." The two solid walls are made of marinite, a standard non-combustible, fire-resistant material. A fire burner, which simulates the burning floor of an actual room, is activated and fire begins to crackle up the walls.

"A fire is hotter and stronger in a corner than along the surface of a wall," explains

“We have in the building right now a functional, mobile robot . . . It can be guided remotely to enter rooms, climb stairs, and even crawl over beams and debris.”



Kozo Saito



William Gruver

Saito, "so that's where we want to create our fire." An infrared camera and a video camera record the height of the flames and the heat distribution in the corner. Then a computer, connected to these cameras, allows the researchers to make a temperature profile.

"What we are trying to do is describe or represent the situation, the environment, in some mathematical sense so that a robot given this information will be able to predict future developments," says Gruver. "Where is the hottest center of the fire? In which direction is it spreading the fastest? The robot will need to be able to know this to respond accordingly."

Gruver explains that the logic and speed with which a robot will react will improve as techniques such as artificial intelligence ex-

continued on page 12

Fighting Fire with Technology A Robot to the Rescue?

An essential part of the robot's intelligence system will be its ability, after entering a burning building, to decide where the hottest part of a fire is located.



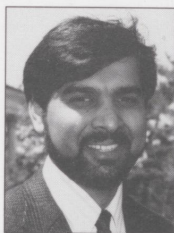
On a tour of the robotics and manufacturing systems building, third graders from Arlington Elementary School get acquainted with the center's mobile robot.

pert systems continue to develop. "A rule might be that if situation A occurs, the robot reacts in a defined way. If scenario B happens, it reacts in some other way," Gruver says. The researchers' goal is to program the robot to prompt the operator to make logical and effective decisions based on the facts of the situation at hand. "The two main keys to developing the functions of the robot," he adds, "are the computer and the software."

The most difficult task for the research group, Gruver admits, will be to integrate various sense-related information the robot needs to be an effective fire fighter. In addition to "seeing" the fire and interpreting what it sees, the robot will need to be able to use other sensory information as well. "When a person goes into a blazing building, he not only sees the fire, but feels it because of the radiation it gives off; he hears it and smells it," Gruver says. "How do we combine visual information and thermal information, and also program in a sense of smell? How will the robot be able to distinguish smoke from burning plastic, wood, foam?" For the robot to make a complete decision, all of this information must be integrated into what Gruver calls an environmental model.

Another challenge for the researchers is robot mobility—the robot needs to be able to move into a burning room, for example, before any decisions can be made about the nature of the fire. Mehrotra says that work is now underway in the center to develop the robot's capability to move and open doors on human instruction. "If we position the robot on the top floor of this building, for instance, and tell it to come down two floors and open this door," Mehrotra says, gesturing toward a closed door, "it should be able to do that. We'll probably do our first tests of this capability in six to eight months," he says.

A crucial part of the complete development of this robot will be the refinement of the robotic hand so that it can turn a doorknob and grasp objects (such as a firehose) tightly, adds Gruver, whose primary research interest is in robotic mechanisms and sensing. Tech-



Rajiv Mehrotra

nology in this area has remained "fairly rudimentary," he says. "The difficulty in giving dexterity to remotely manipulated devices is that the grippers are usually very primitive." The "hands" usually resemble jaws that work together or three fingers that work like a claw. "So one of our projects in the center is focused on developing jointed fingers that enable us to emulate the dexterity of the human hand." He explains that a current project at the center involves the development of multiple-fingered robotic hands that have up to nine directions of motion. With such a degree of dexterity, the robot's "hands" will come close to emulating the facility of a human hand for grasping and manipulation.

With so many problems to solve, and the final hurdle of integrating all of these developments, are the researchers daunted by the challenge? "No, not at all—it's wonderful work," Saito says. "We have a unique opportunity here at UK to meet the challenge because we have the chance to integrate knowledge from all kinds of people. I don't know of any other university in the world that has our interdisciplinary base for working on fire research."

"People are involved in our programs from mechanical, electrical, materials, agricultural and mining engineering, from computer science and business," Gruver adds, "and that's a lot of human power."

When will this fire fighter of the future become an actuality? "I'd say in 10 years," predicts Mehrotra.

And for an effective robot fire fighter, 10 years is not too long to wait, according to Bill Martin, Kentucky State Fire Marshal, whose office reports 184 Kentucky fire fighters injured and two deaths in the line of duty since July of 1990. "I'm glad to see more and more research in fire technology," Martin says. "This could be an excellent tool to assist us in preventing deaths and injuries, which continue to be the highest for any occupation in the United States." ♦

Other Recent and Ongoing Projects at the Center for Robotics and Manufacturing Systems

Knowledge-Based System for Machinability Assessment

Study of tool wear/tool life, cutting power, chip control, surface finish, and machining accuracy for use in the metal-cutting industry.

Quality Monitoring in Manufacturing

Use of coordinate measurement devices for assessing the geometric accuracies of machined parts, and using this information to improve the quality of the manufacturing process.

Computer-Aided Manufacture of Custom-Designed Surgical Implants Using 3-D Reconstruction

Manufacturing prostheses, such as a human jaw, for implantation.

Computer Animation of the Embryology of the Heart

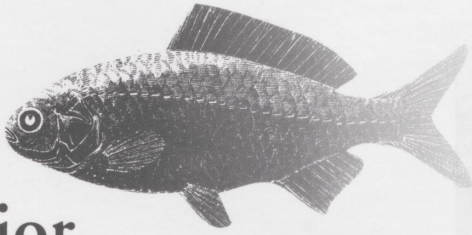
Involves scanning models of embryonic hearts from six days to birth into the computer. The images are then enlarged and rotated. The goal is to develop a set of teaching tools for physicians to study the development of the heart and to recognize where deformities might occur.

Robotic Three-Fingered Dextrous Hand with Tendon-Driven Actuation

A robotic hand with two fingers and a thumb, each of which will be able to bend in three places for use in manipulation tasks in hazardous environments such as fire control and toxic waste clean-up.

Computer-Integrated Flexible Robotic Assembly

Involves using a flexible assembly cell with three robots working together simultaneously to perform assembly of mechanical parts.



Fishy Behavior

by Leigh Gaines

Everywhere you look there are fish. Rows of tanks line the countertops. Tubs sit on the floor. The only sound other than the hum of fluorescent lights is air bubbling up from the aquarium depths.

"These are fatheads," says University of Kentucky biologist Craig Sargent, pointing out a tiny minnow whose head is actually quite small. Although fish are the constant object of his attention, it's not the fish that interest him.

"I work on the evolution of behavior," says Sargent, a vibrant and articulate man in his late 30s. "Fish just happen to be the best system to study the questions I am posing."

Still, fish paraphernalia are everywhere: Taped to his door are "Far Side" cartoons and clips from the *New Yorker*, each depicting talking fish in some impossible situation; a faded fish pinata dangles from the ceiling. Sargent briefly considers the question of whether he likes fish just because they're fish, but is more eager to talk about his research.

With a start, he leaps to his feet, rummages around in a stack of papers and emerges with a handful of published articles and a pen. He reverts to his teaching mode, scribbling a quick outline of his experiments and their scientific tenets.

"Phenomena, hypotheses, theory, predictions, test" is the litany he recites to himself as he writes.

The outline is basic, but Sargent's research is complex. In fact, his study of allopaternal—or stepfather—care in the fathead minnow is not only an inter-

esting link in the chain of evolutionary theory, but an up-close look at the incredibly complex behavior of what appears to be a very ordinary little fish.

"My question is," he pauses, "how do animals 'decide' how to allocate their time and energy among avoiding predators, feeding, mating and parental care?"

"When people ask me what I do, it's sometimes hard to explain this to them in terms of evolutionary biology, but the behaviors I study are really of interest in themselves."

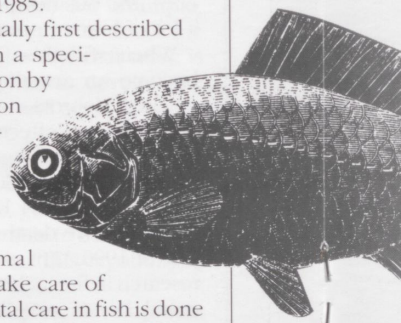
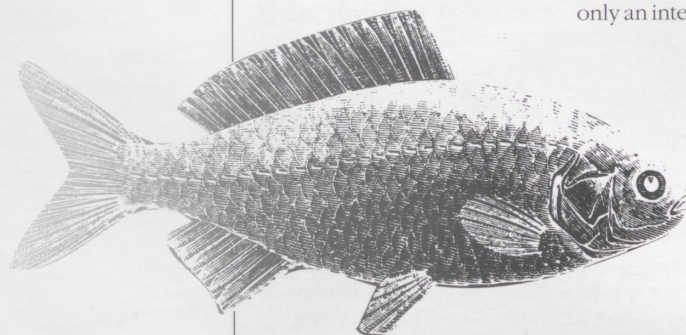
With the recent renewal of a National Science Foundation (NSF) grant, first funded in 1987, Sargent is continuing his work on "Life History Adaptation in Fishes," in hopes of answering his questions. He is also applying his share of a 1989 group NSF "Research Experiences for Undergraduates" (REU) grant to this work.

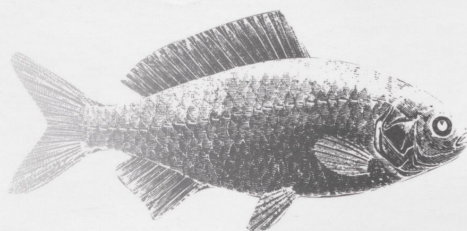
Stemming from his doctoral studies in ecology and evolution at the State University at Stony Brook, Sargent's research on fish behavior has in itself evolved. In the early 1980s, he first studied the threespine stickleback—a classic fish for behavioral studies. Because of its regional abundance, however, the fathead minnow, a small freshwater cyprinid, soft-finned fish became Sargent's new study species when he was hired as a UK assistant professor of biology in 1985.

"The fathead was actually first described over 170 years ago from a specimen caught near Lexington by Rafinesque, a systematist on the faculty of Transylvania University," says Sargent, who frequently interjects such historical tidbits.

Unlike many animal groups, where females take care of the offspring, most parental care in fish is done by males. Thus, parental male fish face all four demands—feeding, avoiding predators, mating and parental care—simultaneously, making it the ideal animal for Sargent's behavioral inquiries.

"And for lab work, fish are extremely useful





Unlike many animal groups, where females take care of the offspring, most parental care in fish is done by males.

because of their small size and high reproductive rate—they can have thousands of offspring, so statistically they provide a lot of data,” says Sargent.

The greatest body of Sargent’s research investigates the evolution of allopaternal care in the fathead minnow. In other words, says Sargent, “Why males adopt and care for other males’ eggs.”

In one experiment, he examines the hypothesis that female fatheads prefer to mate, or spawn, with males whose nests contain eggs over males without eggs. Because males without eggs are at a disadvantage, it benefits them to take care of eggs—even if it means being a stepfather to the eggs of another male.

The predictions were tested in both an aquarium and simulated natural setting. With the help of two undergraduate students hired via the REU grant, Sargent built brick nests and allotted eggs to his tiny subjects.

“We put four females, two males and two nests in each aquarium,” he explains. “We gave eggs to only one of the two males and then recorded with

whom the females spawned.”

True to his expectations, the females showed an obvious preference for mating with males with eggs already in their nests. When the

eggs were switched from the male who had them originally to the other male, the female again preferred the new male with eggs.

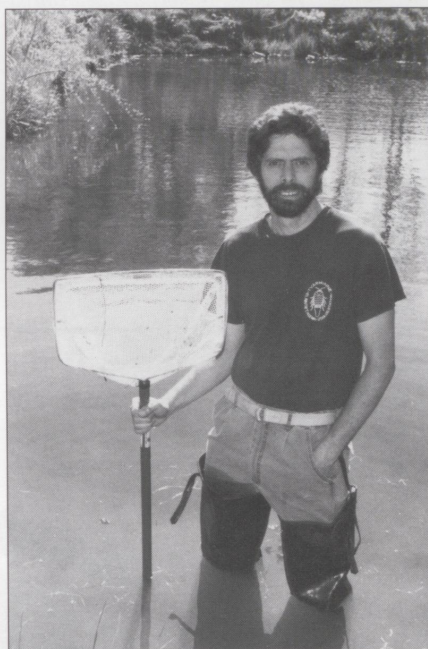
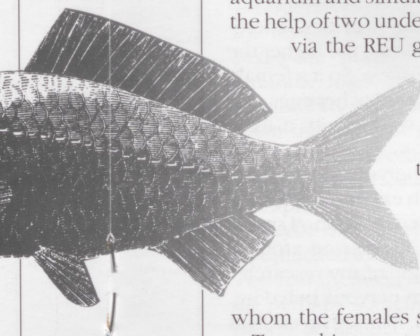
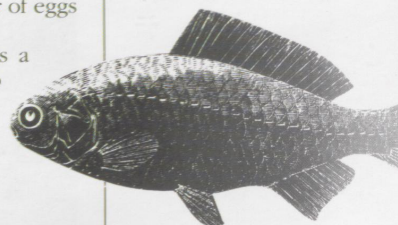
“We also performed a similar experiment outdoors at UK’s Aquatic Research facility on Virginia Avenue,” says Sargent. “There we made an artificial stream with 32 nests and approximately 100 males and 200 females.”

Under these quasi-natural conditions, Sargent and his students observed the same behavior. In addition, they found that the number of eggs a male received through mating on any given day increases with the number of eggs already in his nest.

“The suggestion is the more eggs a male has, the more attractive he is to females,” says Sargent.

In mid-sentence, he wheels his office chair toward a desk drawer where he feverishly searches for photos.

continued on page 16

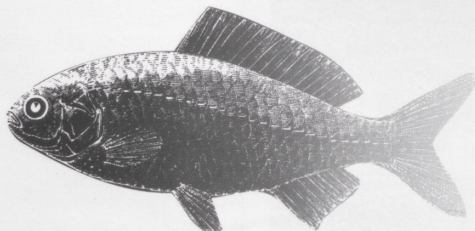


Craig Sargent

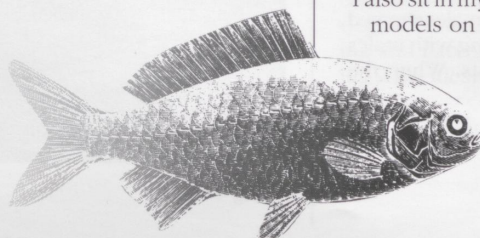
Fishy Behavior



UK undergraduates Amanda Fales and Keith Ledford collect egg-survival data from the artificial stream at the UK Aquatic Research Center.



Sargent claims the behavior he studies is the reverse of a global pattern in which the sexes are stereotyped into masculine and feminine roles.



"Here were my students doing the data collection," he says, holding up a black-and-white snapshot. "It took about four hours per day to do and they had to start early because by noon it was about 100 degrees."

As he talks about his students, a mixture of fondness and pride is apparent. He remarks that of the nine undergraduate students who have participated in his research, six have gone on to veterinary school or to do graduate work in biology. And if any practical benefit of his research is obvious, education surely stands out.

"Perhaps the biggest pay-off often unappreciated by lay people is the educational benefits," says Sargent. "By being involved in scientific research, students learn how to ask questions and find answers—how to think logically."

After puzzling for a moment over certain shortcomings of the educational system, Sargent plunges into a description of "the stuff I'm really famous for."

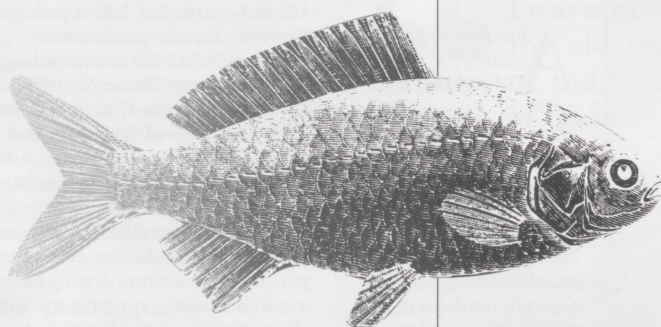
A second outline emerges as he scrawls and repeats the ideas back to himself.

"So now, why do females prefer males with eggs?" he asks.

The hypothetical answer is manifold, beginning with the idea that the amount of care a male provides increases with the number of eggs in his nest; the survival of the male's eggs increases, the more care he provides. Therefore, the more eggs a male has, the higher the percentage of eggs that survive. So if a female wants to ensure the livelihood of her eggs, she will naturally choose to spawn with a male with eggs.

The step-by-step logic pervades every facet of Sargent's research. Each experiment moves systematically towards its conclusion. "I spend a great deal of my time just pacing around, trying to work out the logic of my research," he says, assessing his own nervous behavior. "I also sit in my office a lot, making up endless models on the computer."

In this case, Sargent's logic is seemingly corroborated by the results. In 21 aquari-



ums, one male with one nest was given between 15 and 475 eggs. Sargent recorded the number of times the males rubbed their eggs (not a show of affection, but a method of aerating the eggs), as well as egg survival.

"We found that male care and egg survival both increased with the number of eggs in the nest," he explains. "Therefore, it pays a female to prefer a male with eggs."

Under the "natural" conditions, the students measured only egg survival. The finding: egg survival increased as egg number increased, supporting the lab study.

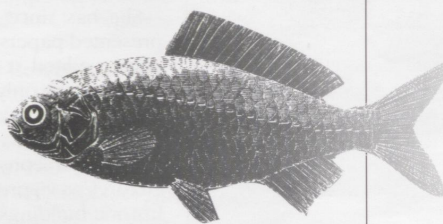
Yet, what does it all mean? What keeps him going?

Sargent claims the behavior he studies is the reverse of a global pattern in which the sexes are stereotyped into masculine and feminine roles. Studying one sex may give insight into the other, he says.

On the topic of motivation, however, he can't seem to verbalize. "I'm just, well, intrigued," he says, at a loss to explain his drive to explore.

Maybe the "Teaching Science Is Fun" button attached to his bulletin board gives a clue. The fish themselves may be another factor. Or perhaps something as simple and complex as an insatiable curiosity is the force that drives Sargent. ♦

“By being involved in scientific research, students learn how to ask questions and find answers—how to think logically.”



HONORABLE MENTION



Benita Howell

by Suzanne Froelich

Anthropology is the study of groups of people, especially of their variety, physical and cultural characteristics, customs, and social relationships. Applied anthropology involves transporting these concerns from academia into the rough-and-tumble world of developers, planners, builders, government officials and community activists. Benita Howell, who earned her doctorate in anthropology from UK in 1978, is an energetic example of applied anthropology in action.

Confident, organized and passionately committed to conserving culture in a development-hungry society, Howell conducted a precedent-setting survey in 1978 that helped define the relatively new area of "cultural conservation."

She has since done other studies, presented papers at dozens of conferences, edited a prestigious journal, served as the only anthropologist on a federal parks planning commission, and emerged as a national spokeswoman for conserving our regional cultures as vigorously as we conserve historic buildings and land.

And all this in 12 years.

"Benita's commitment is obvious from the quite substantial impact she has had," says John Van Willigen,

director of graduate studies for the UK Department of Anthropology and Howell's former professor.

A member of the anthropology department at the University of Tennessee since 1980, the 47-year-old Howell says her love of folk life and lore stems from "several currents" in her life that flow back to childhood.

Reared in Asheville, North Carolina, she was introduced to the unique history and problems of mountain people while accompanying her aunt, a social worker, on calls to Appalachian families. As a child, Howell read "everything I could find about Native American Indians" and was awed by the wonders of the American Museum of Natural History in New York, which she visited when she was nine.

Unable to relate her fascination with folklore to a career goal, she majored in English at Duke University, then earned her master's degree in library science at the University of Illinois, where she worked as a librarian for five years. When her husband, Thomas Howell, accepted a teaching position in UK's music department in 1971, the couple moved to Lexington.

Howell reevaluated her career. She loved folklore but wanted to do more than catalog it. In 1973, she enrolled in UK's three-year-old graduate program in anthropology. At the time, the program was gaining international attention as a pioneer for its emphasis on something new—applied anthropology.

"Once in the program, I saw many things of interest to me," says Howell. "At UK, everything really clicked academically."

After completing her doctoral work in 1978, she was asked to remain for a year as an assistant visiting profes-

HONORABLE MENTION

sor. During this time, she successfully proposed to the U.S. Army Corps of Engineers that she do an anthropological survey at the 120,000-acre Big South Fork National Recreational Area, then being developed in a remote section of southeastern Kentucky.

"I was afraid the pace of change would kill off the old traditions there—personal stories, histories of industries, handcrafts, a whole raft of elements of traditional culture," says Howell.

She spent two years on the project, which resulted in a report containing specific recommendations on tourism planning, relocation, the kinds of development local residents would accept, what information and materials developers could get, and where they could find them.

Her work was so successful it became a prototype.

"In the past, a lot of cultural information such as music, handcrafts and local histories got lost in the shuffle of development," Howell says. "Big South Fork was one of the few projects where anything beyond archaeological and historical preservation was considered. It expanded our national mandate for preservation to deal with culture and lore."

In 1983, she did a study on cultural conservation for the American Folk Life Center, an arm of the U.S. Library of Congress, and became an active lobbyist for the concept, regularly speaking to anthropological and other groups.

A highlight of Howell's career came in 1984, when she presented a paper on her Big South Fork work to an international conference assembled at Mesa Verde National Park in Colo-

“I was afraid the pace of change would kill off the old traditions there—personal stories, histories of industries, handcrafts, a whole raft of elements of traditional culture.”

rado. "There were participants there from every continent," she recalls. "While I spoke, I had 300 to 400 people hanging onto my every word. It was very gratifying—and it served as a wedge to get the issue before the National Park Service."

Also, Howell was, for five years, editor of *Practicing Anthropology*, a publication of the Society for Applied Anthropology; and she was editor and co-author of *Cultural Conservation in the American South*, an edited volume published by the University of Georgia in 1990.

In 1984, Howell served as the only anthropologist on the Commission for Research and Resource Management for the National Park Service—an appointment that must have played a part in the service's recent decision to add cultural anthropologists to the staff of several of its 10 regional offices.

The next step for Howell is a study, now in the proposal stage, on how Appalachian women have been affected by the fall of male-dominated industries and the rise of female employment—with an emphasis on drinking patterns of Appalachian men. This work was suggested by a substance-abuse program director who observed that local culture needed to be taken into account when formulat-

ing social programs for a community.

"Anthropology is so relevant to everyday life," Howell says. "By understanding the culture of Appalachia, for example, we can better design substance-abuse and other programs that will work there."

After an extraordinarily successful first decade as a working anthropologist, of what is Howell proudest?

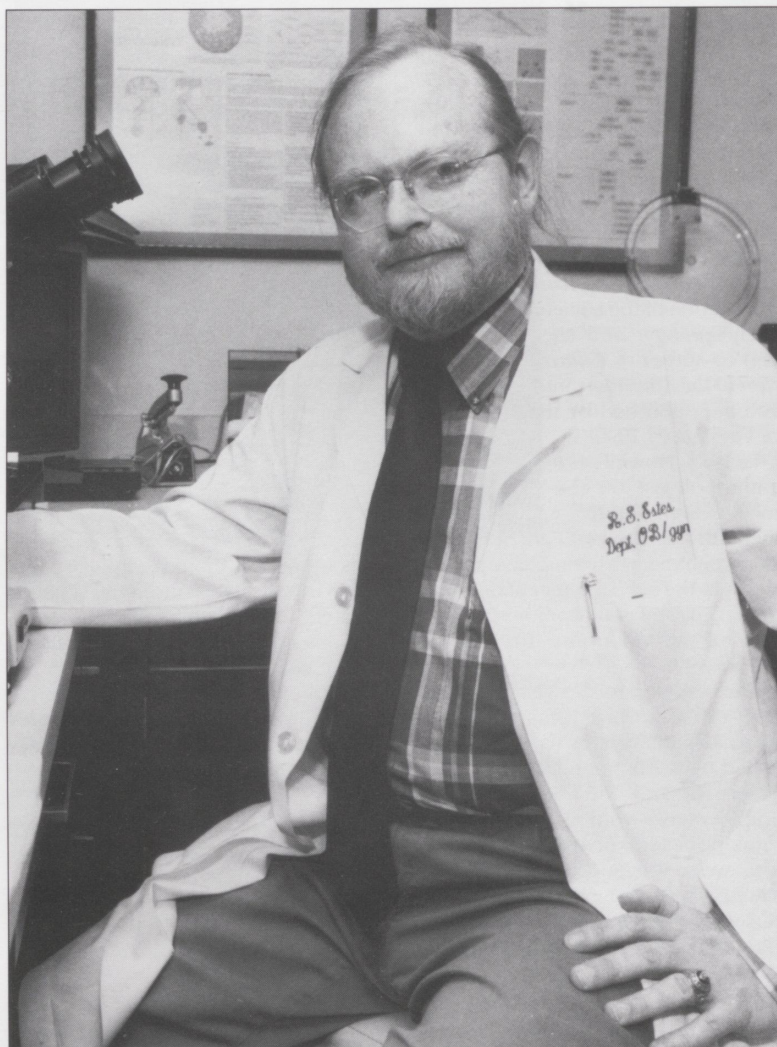
"I am very happy that the park service has created those jobs," she says. "My goal is to see more opportunities come about for anthropologists to work outside academic settings."

She is confident that will happen. "Widespread recognition for cultural preservation is beginning," she says, "as more and more people become convinced that conserving culture benefits not only the folks whose traditions are endangered but, ultimately, all of us."

"Cultural diversity is our strength," Howell says. "If everything becomes homogenized, there is no raw material for change." ♦

BEHIND THE SCENES

R. Scott Estes



R. Scott Estes

Teaming Up against Infertility

by Suzanne Froelich

It is difficult for R. Scott Estes to explain to non-scientists what precisely he does with the microscopes, motility analyzers and micro-computer graphics that crowd his desk in a corner of the antiseptic-looking lab of the College of Medicine's Center for Reproductive Medicine.

But when his work with these high-tech tools goes well, the result is as sweet, simple and miraculous as a newborn baby.

Estes, an intense 37-year-old clinical research assistant who wears his shoulder-length blond hair in a neat ponytail, is part of a team that in the past six years has helped approximately 400 infertile couples achieve pregnancies through artificial insemination, in-vitro fertilization, inter-fallopian tube transfers and other state-of-the-art ways of getting the stork to deliver.

"I really enjoy the patient contact in this job," says Estes, who has held a series of scientific positions at the university during the past 14 years. "I feel I am making more of a difference when I can talk with patients."

"Scott is a very important support person here," says Thomas Curry, assistant professor of obstetrics and gynecology and Estes' supervisor. "What he does has a great deal of influence on what we do."

Estes spends about 60 percent of his time working with sperm-testing and interviewing donors, evaluating and freezing samples, and explaining procedures to patients. He also runs the lab, conducts tests and helps analyze findings for research papers, and sets up the center's computer data bases. And although it is not in his job description, he is

the center's de facto computer guru. "Scott is the one we all go to when we have [computer] problems," notes Curry.

The considerable scientific know-how Estes exhibits is a tribute to intellectual diligence and on-the-job training.

"I've pretty much followed the lead of people I've worked for," Estes says. "I've learned techniques along with them by reading journals, going to scientific meetings and talking with other scientists. The learning process in science is very interactive because things are always changing."

A Winchester, Kentucky native, Estes attended UK full-time for four years in the early 1970s, but left without a degree. "I changed majors five times—I was directionless," he concedes with a self-forgiving smile. With no clear career plan, he went to work in 1977 as a computer technician with the UK Medical Center pharmacy.

Four years later, he moved to the Wenner-Gren Biomedical Engineering Research Laboratory, where he learned research skills by assisting in animal experiments aimed at studying electrical magnetic effects on neural tissue.

In 1985, Estes was hired at the newly opened Center for Reproductive Medicine, where he supplemented his computer and lab work with regular patient contact—a change he welcomed. A third of his time is spent assisting physicians in research.

"Sometimes I am just a pair of hands (carrying out the researcher's instructions), but other times I help design experiments and interpret results," says Estes, whose name is listed on more than a dozen research papers and studies.

Studies to which he has contributed include those in which researchers:

“When the baby was born, we held a press conference and went to the hospital to see the baby. Everyone at the center was excited. To have a baby to hold up for the cameras was really something.”

- Are trying to develop a sperm-freezing technique that will allow for a higher survival rate than with the present system, in which half or more sperm cells die. This study is ongoing.

- Extracted sperm from the urine of men whose semen traveled through the bladder, rather than along the normal route, and used it successfully in in-vitro fertilizations. This extraction method had been used in artificial insemination, but never before in in-vitro fertilization.

- Determined that sperm cells survive very well in the fallopian tube—the final stretch of their heroic journey to the egg in conception. This finding could lead to further advances in infertility treatment.

"What has amazed me about scientific research is the smallness of the questions we ask," muses Estes. "We ask one tiny question at a time, with the sum of many answers addressing the larger questions."

Estes likens scientific work to war, describing it as "long hours of boredom interspersed with a few brief moments of intense excitement." Most of these moments pass unnoticed by the larger world.

"I remember once I was working on these little chromatography columns, trying to separate single- and double-stranded DNA," he says. "They weren't separating; all I was getting was garbage. After a long while, I figured out how to wash and prepare the column so it worked—they began to separate! Now that was exciting, but it was something most people wouldn't understand."

Occasionally, scientific triumphs have such widespread impact they are cheered like a Fourth of July parade. This was clearly the case when Kentucky's first in-vitro baby was born at the UK hospital in the spring of 1986.

"Our part was over at the conception, but we worried all through the pregnancy," says Estes, who had processed the husband's sperm for this headline-making test-tube miracle. "When the baby was born, we held a press conference and went to the hospital to see the baby. Everyone at the center was excited. To have a baby to hold up for the cameras was really something."

Yet it is not just his work that keeps Estes on campus 20 years after he first enrolled here as a freshman. He likes the milieu. He has attended classes sporadically over the years and is a few credits short of his undergraduate degree in general studies. He lives in a house across from the College of Agriculture, he is a member of St. Augustine's Chapel, he goes to concerts and art exhibits on campus, and most of his friends work, teach or live here.

"People at a university tend to be intelligent and driven to answer questions more than they are driven by money or power," he says. "I like that. That is why I stay here." ♦

KIOSK

Just What the Soil-Doctor Ordered

If UK research tests of a new machine developed in Texas pan out, local farmers might have the best of two worlds.

They may be able to know exactly how much nitrogen they need at each part of their field. That means they won't have to spend too much for expensive fertilizers. Nor will they have to worry that they've used too little fertilizer because a soil test in one part of their field didn't reflect the requirements of a different part.

That's because the machine, a tractor-driven device called a "Soil Doctor," measures the nitrogen requirements of the soil continuously, and a computer calibrates and delivers the proper amounts as the tractor passes over the field.

"The machine was tested on the farms of some of our farm participants for the first time this year," says Lloyd Murdock, a UK Cooperative Extension Service soils specialist. "The concept sounds good and the first trials look promising."

The machine was invented just three years ago by Texan John Colburn. The technology was not available until then, Murdock says.

UK was able to borrow a machine, and farmers who are participating in this research project are testing it out.

The machine is expensive, costing anywhere from \$10,000 to \$15,000. But one farmer estimated he saved 40 pounds per acre with it. With nitrogen savings of approximately \$8 per acre, a farmer who plants 1,000 acres of corn may be able to pay for the machine in a few years, Murdock says.

—Jerry Robbins

$$\frac{24\% \times .235\%}{9015 \times .057} > 6721.77 =$$

$$224/32 =$$

$$< 692.04 + 22.879 > =$$

113
113
113
113
113
113

Battling the Calculus Bogyman

It's the bogyman that stands at the entrance to the halls of higher knowledge. Mention Calculus 113 to most incoming freshmen and watch them cringe. But like most terrors, "calculus-fear" can be overcome by an inventive mind and with a little help.

Michael Freeman, of the University of Kentucky's mathematics department, has provided the help—a program called MathExcel. In this system, Freeman explains, "the students use their ingenuity to help each other solve complicated math problems in a workshop setting."

MathExcel is based on a pilot program created by Uri Treisman of the University of California at Berkeley. Treisman noticed that many bright minority students were failing freshman calculus. This failure often caused them to discontinue their education in a math-related field. For some, it was the deciding factor that made them drop out of college.

Treisman knew that most of these students should have done well in math—their test scores had shown that they were capable of doing the

work. He did some research and discovered that it was the students' study habits which made college math so difficult for them. They were suffering from what he called "academic isolation."

In order to stimulate better study habits for these students, Treisman set up workshops for them outside the regular structure of the math course. Students were told to work on challenging calculus problems after receiving little guidance or explanation. The result was that the students turned to each other in order to work the math assignments. This approach helped them gain confidence and experience in problem-solving which aided them in their coursework.

Freeman set up the MathExcel program at UK in a similar manner. Qualified students enrolled in the regular calculus classes are offered the chance to take the workshops as a pass-or-fail grade for two hours of extra college credit. The two-hour workshops are held three times a week and are run by trained graduate students. "The workshops stress cooperation," says Freeman. "Since the workshop leader doesn't explicitly show the students how to do the

problems, they have to ask each other for help."

The MathExcel students are given difficult math problems to work. Sometimes the problems are harder versions of current classwork. Often they involve methods that have not yet been addressed in the regular lectures. "The students must rely largely on their creativity and imagination," Freeman says.

MathExcel has worked well at UK. Students involved in the program say that it has increased their self-confidence in their ability to tackle calculus, in addition to saving them from poor grades. "MathExcel is an exciting and fun experience," says Donny Mathis of Corbin, Kentucky. "I don't know if I could have made an 'A' without it." Shelby Deibel of Crestwood, Kentucky says that when she first walked into MathExcel, "I was afraid that everyone would be smarter than I was. Instead, everyone was like me. We were all struggling hard towards one goal: to pass calculus."

If Treisman's original program is any indication, there should be other benefits in the long run. These students will be very likely to maintain their course of study in science. That means that many of them will end up as researchers, teachers, and technical professionals. As such, they will augment an area in which there is currently a dearth of trained individuals.

By instilling its students with the concept of a cooperative approach to problem-solving, MathExcel will also expose a new generation of potential researchers to the multidisciplinary philosophy. As Freeman explains, "It should foster in these young people the idea that teamwork can help break new ground."

—Melinda Higgins (Susan Wilson contributed to this article)

UK History Grad Publishes Book on Vietnam War Coverage

When Clarence Wyatt earned his Ph.D. from the University of Kentucky in May of 1990, he had already been approached by someone from a prestigious university press who wanted to publish his doctoral thesis as a book. Wyatt's thesis deals with the relationship between reporters, the military, and the government in the Vietnam war zone. "Once one press asked me about publishing a book, I started to get encouragement from people in the history department to try to interest other publishers in the book," the Hopkinsville, Kentucky native explains.

Wyatt's specialty is American diplomatic history. He earned a B.A. from Centre College in Danville, and has a master's degree in history from UK. He says his interest in Vietnam stems from early personal experience—his brother was a marine in the war.

"My doctoral advisor, George Herring, got me interested in the role of the press in American foreign policy," Wyatt says, "and I decided to take a look at how the press had influenced government policy in Vietnam." Wyatt explains that there has been a popular view that the press was responsible for the turn of opinion against the Vietnam war. "The backlash got stronger in the early 1980s. Especially after President Reagan [in looking back at the war] made his comment about Vietnam being a 'just and winnable war,' the public began to feel that the press was responsible for our failure in

Southeast Asia." Wyatt decided to see whether this idea had any basis in fact.

"The reality of the ties between the government and the press in Vietnam is far more complicated than most people realize," Wyatt says. "The two roles were actually complementary. The idea that the journalists were out to undermine the government and the opposing view that the government tried to stonewall reporters are both too simplistic." In actuality, Wyatt explains, there was an understanding between the military and the press during the Lyndon Johnson era of the war. There were guidelines set up by the military as to what reporters could write about. No censors read daily news reports. "It was understood that to report restricted information such as future missions or rescue attempts would result in the offending journalist's removal from Vietnam," Wyatt says. "As long as they followed the set rules about classified content, reporters could travel anywhere they wished."

In late 1991 W. W. Norton will publish Wyatt's book, titled *Paper Soldiers*. "The book is a study of the forces that shaped the reporting of the Vietnam conflict, how stories were covered, and what kinds of stories were covered." And, Wyatt says, the book should help exonerate journalists from blame in the tragic outcome of the war.

Wyatt is currently teaching history at Centre College in Danville.

—Melinda Higgins

Similar Terrains, Similar Strains: Conference to Focus on Canada and Appalachia

The region has mountains and wild forestlands and a rich native culture. Its natural beauty attracts tourists from all over the continent. It is for the most part dependent on mineral extraction and agriculture for its livelihood. And it is caught in a tug-of-war between those who want to conserve and those who wish to exploit its resources. Poverty and unemployment are increasing problems for the region, and the lack of jobs and opportunities has forced many of its natives to move elsewhere to find work. Efforts to develop the area economically have had spotty results so far.

These problems will sound familiar to anyone living in the Appalachian region of the United States. But this is a description of a different area of North America—Canada's Atlantic Provinces.

Most Americans tend to think of Canada as our quiet neighbor to the north, a sort of gentle sleeping giant. We often forget it is our largest trading partner. And it may not have occurred to us at all that Canadians are confronting many of the same developmental and economic problems that the Appalachian area faces.

The University of Kentucky Appalachian Center and Northern Kentucky University are co-sponsoring a conference to discuss the similarities of the Appalachian and Canadian regions. "Two North American Regions in Stress: A Conference on Common Development Issues and Strategies"

will be held at UK on June 21-22, 1991. The goal of the conference is to foster international understanding and cooperation between the two areas. This will be the first time leaders from these two regions meet to discuss interests and problems common to both.

The cost of attending the conference is \$40. For further information, contact the Appalachian Center, University of Kentucky, 641 South Limestone, Lexington, KY 40506-0333 or call (606) 257-4852.

—Melinda Higgins

Light Life Cheese?

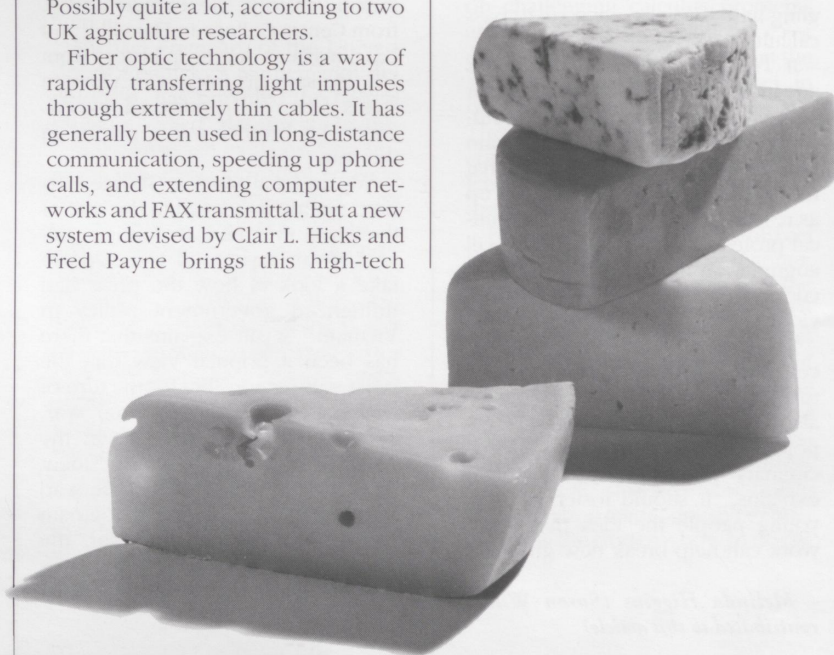
What do fiber optics have to do with cheese production in Kentucky? Possibly quite a lot, according to two UK agriculture researchers.

Fiber optic technology is a way of rapidly transferring light impulses through extremely thin cables. It has generally been used in long-distance communication, speeding up phone calls, and extending computer networks and FAX transmittal. But a new system devised by Clair L. Hicks and Fred Payne brings this high-tech

wonder to one of the world's oldest industries.

Hicks is a dairy technology researcher, and Payne is an agricultural engineer. They have been trying to find a way to increase the yield of Kentucky cheese producers. The process of making cheese is fairly tricky, and one of the hardest factors for cheese-makers to control is the time it takes milk curd to coagulate. The curd must be cut into squares at just the right time during the gelling process, or the resulting cheese will be too soft and have a high moisture content.

Because it is so difficult to determine the exact time when the curd should be cut, cheese manufacturers often end up with cheese of lower quality and yield. Hicks and Payne



wanted to find a precise way of monitoring the gelling process. "We tried ultrasonic waves and electrical capacitors," says Payne, "but they just didn't work."

Then the researchers tried light technology. They discovered that the milk curd reflected light at different levels during coagulation. Once this difference was determined, Payne developed a fiber optic device to measure the amount of light reflected by the milk. One fiber optic cable was connected to a small light bulb. It carried light from the bulb into the milk curd. When the light was reflected by the milk particles, it was picked up by another optic cable and carried to a machine which measured the amount of reflection.

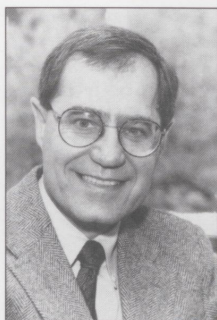
Results were charted on a computer. "After more than 80 tests covering a wide range of variables," Payne says, "we were able to develop a computer program which could predict precise times for cutting the gel."

The device will be tried out in a Kentucky dairy to see how effective it is in a practical situation. "Ideally, the fiber optic technology will enable cheese makers to have greater control over the quality and quantity of the cheese they produce," says Payne. "The end result for Kentucky farmers should be more high-quality cheese at lower production costs."

UK Researchers Appointed to National Posts

UK sociology professor Richard Clayton has been asked to serve on the nine-member National Advisory Council on Drug Abuse. Clayton, scientific director of the UK Center for Prevention Research, will be the only social scientist on the panel.

Advisory council members are ap-



Richard Clayton

pointed by Secretary of Health and Human Services Louis W. Sullivan. Their mission is to offer information and advice to the secretary and to the director of the National Institute on Drug Abuse in Washington. Members serve four-year terms, during which they analyze and provide insight into public policy and research on drug abuse.

Clayton's background in the study of substance abuse is extensive. He has close to 20 years' experience in researching drug abuse issues, and he wrote the key chapters in the First and Second Triennial Reports to Congress, in which he outlined the problem of drugs in the United States. Clayton has taught sociology at the University of Kentucky since 1970 and was instrumental in bringing the National Center for Prevention Research to UK in 1987. The university was selected in a nationwide search as the home for the center.

Among his other honors, Clayton was a University Research Professor in 1984 and received UK's Great Teacher Award in 1987.

Steven Yates, of UK's chemistry department, has recently been appointed to three distinguished posts. Last June, Yates was asked to serve on the Nuclear Science Advisory Committee. This group reports to the National Science Foundation and the Department of Energy. "I'm the designated representative for nuclear chemistry," Yates explains. Committee members are appointed



Steven Yates

by the U.S. Secretary of Energy to help make decisions about money appropriations and priorities in the basic nuclear sciences.

This year, Yates is acting as chair-elect of the Division of Nuclear Chemistry and Technology of the American Chemical Society. The ACS is the largest society of disciplinary scientists in the world, comprising over 137,000 members in 32 divisions. Yates will become chairman of the nuclear chemistry division in 1992.

In addition to these appointments, Yates is in the middle of a term on the Committee on Nuclear and Radiochemistry, a sub-group of the National Research Council. He is responsible for coordinating monographs prepared by the group, which serves the National Academy of Sciences.

"All of these are three-year appointments," Yates says, "which certainly takes a lot of my time, but I think that these positions have helped UK attract more outstanding students." Yates explains that the exposure generated by service on these committees helps with recruitment. "Teachers send their promising graduate students to the places they feel will offer them the best learning experience," he points out. "The fact that UK has nationally recognized experts in nuclear chemistry and radiochemistry looks very good to potential graduate students. We have built a first-rate program here at UK," Yates says. "It's nice to see both it and the university get some attention."

—Melinda Higgins

Losing Pounds a Winning Rx for Diabetics

John, a 52-year-old businessman, hadn't been feeling well for some time. He always felt tired, sort of off-balance. Sometimes pain shot through his lower legs. Sometimes his legs went numb. And despite the fact that he weighed 275 pounds, he just couldn't seem to get motivated to lose weight. Besides, he was so hungry all the time. . .

John was a diabetic. His doctor told him he had Type II diabetes, which meant his body didn't produce enough insulin. The doctor put John on insulin and oral medication to control the disease, but John hated taking insulin shots, and he often forgot to take his pills. He also kept gaining weight.

John's story is all too common. But new research at the University of Kentucky could help give him a better outlook and a healthier life.

James Anderson, of UK's College of Medicine, has studied diabetes for 18 years, and he has recently completed a study which holds good news for diabetics like John.

In a three-month study of obese persons with Type II (non-insulin dependent) diabetes, Anderson found that weight loss and improved diet can significantly lessen the amount of medicine these people must take. "By developing a successful intensive weight-loss program for obese persons with Type II diabetes, we feel

we have laid the foundation for future research and treatment," Anderson says.

A diabetic person's body is incapable of transporting sugar from digested food out of the bloodstream. Unless medicine is taken, the sugar remains in the blood. High blood-glucose levels can harm important organs such as the liver and kidneys. And if the cells in the body don't receive the sugar for nutrition, they can't rebuild and heal themselves. Some diabetics' bodies no longer produce insulin, the protein responsible for removing the sugar from the blood and feeding it to the cells. This kind of diabetes is known as juvenile, or Type I. Type I diabetics must inject insulin daily.

In the second type of diabetes, a person's body still produces insulin, but it is not as effective as it should be in transporting sugar out of the blood. Although there can be many reasons why a person contracts Type II diabetes, researchers have known for a long time that obesity is a common trait among Type II diabetics.

Anderson wanted to see exactly how weight loss affected obese people with Type II. He also was interested in determining what diets would be best for these people. The 39 study participants were randomly placed in one of two groups. One group was put on a strict liquid diet, while the other group had two meals a day consisting of the liquid supplement and one full, high-fiber meal. Members of both groups were limited to an intake of 800 calories a day. "In addition to the diet, we had them on a regular exercise program, and we educated them about diabetes and

their diet," Anderson explains.

The total weight loss for the groups was roughly the same, an average of 34.3 pounds per person. But the important thing Anderson learned was that with the weight loss came a decrease in the amount of medicine each patient needed to control his or her diabetes. By the end of the study, 25 out of the 29 participants on medication had been taken off their medicine entirely.

"Fat absorbs insulin and makes it very ineffective," says Anderson. "We have proved that a significant weight loss can help a person function with little or no extra medication."

Controlling diabetes through weight loss and proper diet is not only more effective, it is much less expensive. "The cost savings on medicine for this study averaged about \$38 less a month per person," Anderson says. For the patients who are taken off medication, there will be no more side effects such as hypoglycemic (low-blood-sugar) attacks or problems with forgetting pills or shots. "That's the best part," Anderson smiles. "Treating the disease in this way provides a higher quality of life for the patients."

—Melinda Higgins (Ellen Razor contributed to this article)

Tuska: "Non Basta Una Vita"



John Tuska

Their fleshy buttocks and muscular backs are symphonies of suspended motion. From tables, cartons and shelves, they kick, run, reach, tumble and sprawl seductively. Even the unfinished ones suggest life. Turning away, you can almost feel their frozen gazes warm the nape of your neck.

The exquisite bronze, clay, wax, wood and paper figures that inhabit the studio of John Tuska are works in progress—each a testimony to the considerable talents of

this versatile artist, who for almost two decades has been turning out internationally praised works from his sun-filled corner of the Reynolds Building on the northwest edge of campus.

The ceiling of Tuska's studio is a network of peeling pipes and bare lightbulbs that illuminate the powdery dust that seems to coat everything below. Artist's materials of all sorts are stored in old pickle jars and cardboard cartons. On a crowded worktable lay sketches, clumps of

wax, tiny brushes and a Sprite can twisted into a tiny torso.

"Obviously there is a clutter of stuff here—I like to work this way because my brain, my upstairs, is like this," says Tuska, tapping the unruly gray hair on his head and glancing fondly around the disheveled room.

ODYSSEY last featured Tuska, a 60-year-old art professor who has been at UK for 28 years, in 1982

continued on page 28

“A thousand people can sit in the same chair, yet each will do something different in that chair. There is a marvelous flux to the human form that, to me, is tremendously exciting.”

while he was on a one-year leave to experiment with cast-paper sculpture and other new techniques. Then, he was rising at 5:30 each morning and getting up in the middle of the night to jot down thoughts. “Sometimes, I feel like a driven person,” he said at the time.

Heart surgery in 1986 and a mild stroke the following year have forced him to reduce his workdays by about half. Through it all, his artistic vision has not only remained strong but has been enriched, he says.

“In the last five years, my work has become infinitely more introspective; I see myself in relation to the world around me. I see society as very fragmented and torn apart, and I suppose in my work I am trying to bring it together again.”

Trained as a potter at New York State College of Ceramics, Tuska has mastered many mediums—drawing, painting, paper-making, wax-making, and sculpting in clay, cast-paper, wood, bronze and other materials. On a 1969 sabbatical in the bronze foundries of Rome, Italy, he developed an intense, enduring fascination with the human form.

“I see the human form as different all the time,” he says. “A thousand people can sit in the same chair, yet each will do something different in that chair. There is a marvelous flux to the human form that, to me, is tre-

mendously exciting. In Rome, I saw what artists have done with this over the centuries.”

Critics who have seen Tuska's work at shows and galleries throughout the United States and half a dozen foreign countries have called his work vital, powerful, lyrical and truly original.

“Whether Tuska's figures are two- or three-dimensional, they always convey a sense of being alive,” says Jim Edgy, assistant director of the Cincinnati Art Museum and the owner of several Tuska pieces. “There is an energy and vitality in his figures that is lacking in so many artists' work.”

Several years ago, Tuska was selected to do a bust of the late Sen. John Sherman Cooper, which was dedicated at the state capitol in 1988. During a 25-year retrospective of Tuska's career the following year in Lexington, his works were simultaneously exhibited at half a dozen Lexington sites for six weeks.

Although Tuska has achieved considerable success at home and elsewhere, some observers note his reputation would be even greater had he chosen to live in a major art city and aggressively promote himself.

“Over the years, John has turned out extraordinarily high-quality work, but he has never been driven

to go out and market himself,” says Edgy. “That probably has been good for his art, but detrimental to his visibility and recognition.”

One gets the impression that the current work in progress is always Tuska's top priority. In addition to teaching two afternoons a week, he now has three major projects underway:

- A facade for the university's Fine Arts Building that will contain more than 30 three-foot-high bronze figures. He hopes the facade will be ready within two years.

- A free-standing sculpture of five or six 20-foot-high figures for the rotunda of the Lexington Public Library. Tuska will design and oversee the work, which will be done by craftspeople elsewhere.

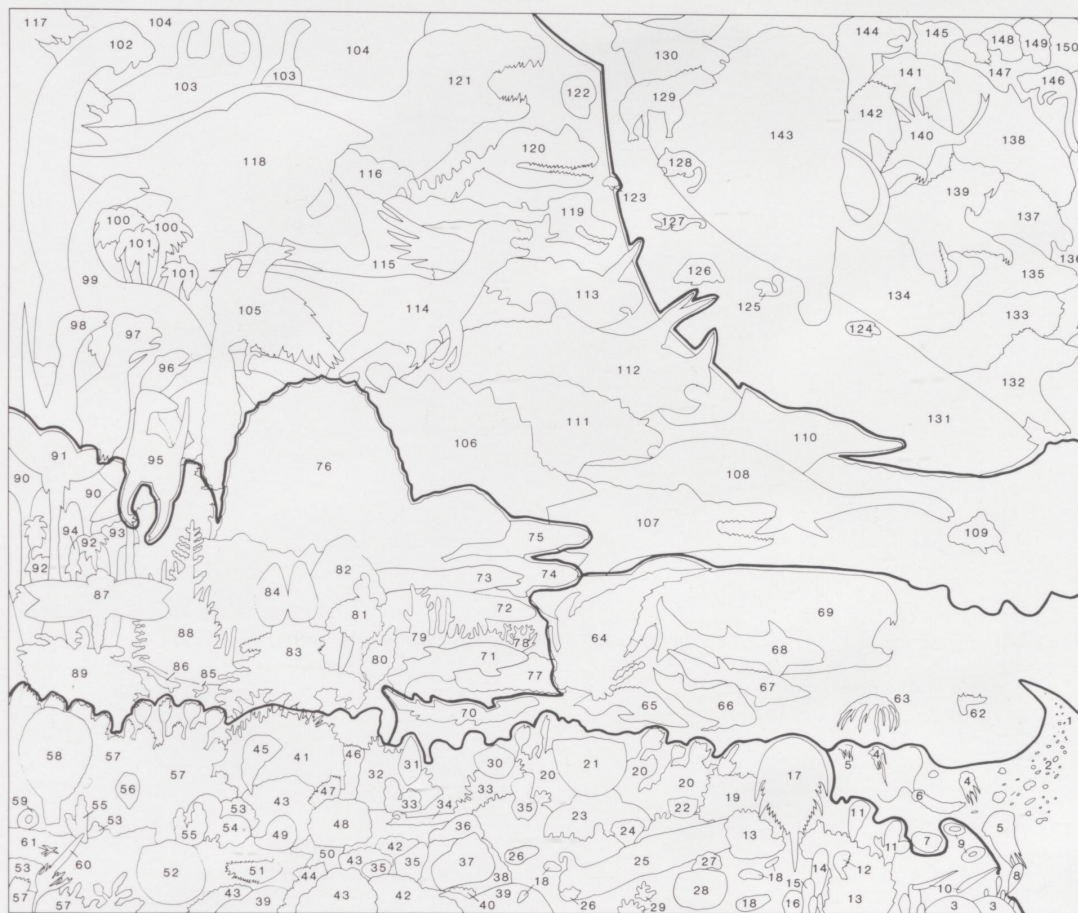
- A 45-inch kicking figure to complement a Tuska piece already installed in the board room of Central Bank and Trust Company.

Because his work requires enormous physical strength, Tuska must pace himself these days. “It is difficult—I still have all these thoughts up here, yet I don't have the time to put them all down here,” he says, tapping first his head then his worktable.

One can only imagine how frustrating slowing down must be for a man who has, for a decade, displayed on his studio wall the motto “Non Basta Una Vita,” or “One Life Is Not Enough.”

“I have always been a person who does a lot of work in a lot of mediums. I want to go through everything, making discoveries along the way. You see,” he says only half in jest, “I want to know everything before I die.” ♦

—Suzanne Froelich



Key to Cover

Cover illustration by
Stephen Greb

PRECAMBRIAN LIFE

1. blue-green algae cells
2. eucaryote cells
3. stromatolites
4. *Cyclomedusa*, jellyfish
5. *Brachina*, jellyfish
6. *Spriggina*, marine worm
7. *Dickinsonia*, marine worm
8. *Charniodiscus*, sea pens

PALEOZOIC MARINE

INVERTEBRATES

Cambrian Period

9. *Peytoia*, jellyfish
10. lancelets
11. *Vauxia*, sponges
12. *Canadaspis*, arthropod
13. archaeocyathids
14. *Chancelloria*, sponges
15. *Mackenzia*, sea anemones
16. *Eiffelia*, sponges
17. *Olenellus*, trilobite fossil
18. *Calymene*, trilobites

Ordovician Period

19. *Hallopora*, bryozoan
20. crinoids
21. *Rafinesquina*, brachiopod fossil
22. *Platystrophia*, brachiopod fossil
23. *Tetradium*, coral
24. *Brachiospongia*, sponge
25. *Endoceras*, brachiopod
26. *Isotelus*, trilobite
27. brachiopods
28. *Dinorthis*, brachiopod fossil
29. *Constellaria*, bryozoans

Silurian Period

30. *Atrypa*, brachiopod fossil

31. *Pentamerus*, brachiopod fossil
32. *Pachydictya*, bryozoan
33. *Phaenopora*, coral
34. *Orthoceras*, cephalopod
35. fenestrate bryozoans
36. *Heliolites*, coral
37. *Cyclonema*, gastropod fossil
38. *Arachnophyllum*, coral
39. *Plasmopora*, coral
40. brachiopods
41. *Cladopora*, coral
42. *Halsites*, coral
43. *Favosites*, coral
44. *Cystiphyllum*, coral

Devonian Period

45. *Zaphrentis*, coral fossil
46. *Siphonophrentis*, coral
47. *Heterophrentis*, coral
48. *Eridophyllum*, coral
49. *Hercoceras*, nautiloid
50. brachiopods
51. *Terataspis*, trilobite
52. *Paracyclas*, bivalve fossil

Mississippian Period

53. *Menophyllum*, coral
54. *Lithostroton*, coral
55. *Archimedes*, bryozoans
56. *Pentremites*, blastoid fossil
57. crinoids and blastoids
58. *Forbesiocrinus*, crinoid fossil
59. crinoid columnal fossil
60. crinoid with anal sac
61. brittle star

OTHER PALEOZOIC

AQUATIC LIFE

62. conodont fossil

63. graptolites
64. *Eurypterus*, arthropod

Vertebrates

65. *Pteraspis*, fish
66. *Pterichthyodes*, fish
67. *Cephalaspis*, fish
68. *Cladocelache*, shark
69. *Dunkleosteus*, fish
70. *Osteolepis*, fish

PALEOZOIC

TERRESTRIAL LIFE

Vertebrates

71. *Eusthenopteron*, lungfish
72. *Ichthyostega*, amphibian fossil
73. *Hylonomus*, reptile
74. *Seymouria*, reptile
75. *Limnoscelus*, reptile
76. *Dimetrodon*, reptile

Early Plants

77. *Cooksonia* and *Steganotheca*
78. *Rhynia*
79. *Asteroxylon*

Devonian Period

Forests

80. *Hyenia*, ground plants
81. *Eospermopteris*, tree
82. *Archaeopteris*, tree
83. *Rhacophyton*, ferns

Pennsylvanian

Period Swamps

84. millipede fossil
85. scorpion
86. reptile
87. *Homaloneura*, insect
88. *Calamites*, reeds
89. *Neuropteris*, ferns

90. *Lepidodendron*, trees
91. *Sigillaria*, trees
92. *Medullosa*, tree ferns
93. *Psaronius*, tree ferns
94. *Lepidodendron*, seedling tree

MESOZOIC LIFE*

95. *Hesperosuchus*, pre-dinosaur
96. *Coelophysis*
97. *Dilophosaurus*
98. *Struthiomimus*
99. *Plateosaurus*
100. *Williamsonia*
101. *Bjuvia*, tree
102. *Apatosaurus*
103. sauropod herd
104. sauropod trackway fossils
105. *Archaeopteryx*, first bird
106. *Stegosaurus*
107. *Tylosaurus*, marine reptile
108. *Elasmosaurus*, marine reptile
109. *Baculites*, squid-like animals
110. *Ichthyosaurus*, marine reptile
111. *Ankylosaurus*
112. *Triceratops*
113. *Styracosaurus*
114. *Deinonychus*
115. *Magnolia*, flowers
116. angiosperm trees
117. *Sequoia*, conifer tree
118. *Parasaurolaphus*
119. *Brachiosaurus*, dinosaur skeleton
120. *Ceratosaurus*, dinosaur skeleton
121. *Tyrannosaurus rex*
122. ammonite fossil
123. *Palaeoryctes*, mammal

CENOZOIC LIFE**

124. *Diacodon*
125. *Paramys*
126. *Trionyx*, turtle
127. *Plesiadapis*
128. *Prilodus*
129. *Hyacotherium*
130. *Pliohippus*, horse skull
131. Blue Whale
132. *Phenacodus*
133. *Coryphodon*
134. *Brontotherium*
135. *Glyptodon*
136. grass
137. *Dinobius*
138. *Baluchitherium*
139. *Smilodon*
140. *Synthetoceros*
141. *Megatherium*
142. *Moropus*
143. Woolly Mammoth
144. *Diatryma*, bird
145. *Aepyycamelus*
146. *Notharcus*
147. *Australopithecus*, skull
148. *Homo erectus*, skull
149. Cro-Magnon man, skull
150. Modern man

* Animals are dinosaurs unless otherwise noted.

** Animals are mammals unless otherwise noted.

ODYSSEY

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

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

