studies to waste time organizing their own defense or get out of the field.

Physician Joseph Fischer agrees. In 1993, he left the Medical College of Georgia in Augusta and quit research after his university failed to defend him from a broad tobacco company subpoena. Fischer was the author of one of three articles in *JAMA* in 1991 that tracked the use of Joe Camel ads and trends in teenage smoking (*Science*, 19 June 1992, p. 1620). Reynolds demanded access to all the authors' records, even though Fischer says he and another author were not cited in litigation and did not testify as expert witnesses. Fischer says he had to raise funds for his own defense and that after an initial victory, he lost. The court ordered him to surrender everything in his files, deleting only the names of the children he had interviewed. "I considered it unethical" to make the data public, he says, and "it became untenable for me to serve on the faculty any longer." He is now in private practice.

The tobacco industry, however, says it needs access to research records in order to defend itself against litigation. Reynolds spokesperson Peggy Carter says the company "feels we have a right to see and understand the underlying data" from a study that may be used against the company. "Often, the information that is not reported is as significant as what is reported," Carter says. She adds that she regards Pierce as an antismoking advocate of long standing.

In addition, Carter points out, Pierce has served as an expert witness in earlier suits against the industry. He has also been named an expert witness by plaintiffs in a pending case in which 18 cities and counties are suing in state court to halt certain cigarette ads on grounds that they violate state laws against endangering the health of minors. These local agencies—joined by state chapters of the American Heart Association, the American Academy of Pediatrics, and other health groups—intend to cite data from Pierce's *JAMA* article to support their case, and they plan to ask Pierce to testify. In light of this, Reynolds sees nothing wrong in subpoenaing Pierce's records.

Patti agrees that it is fair to subpoena some records of people who serve as expert witnesses. But he notes that in the state suit, Reynolds has jumped the gun on the 15 June starting date set by the court for collecting data from expert witnesses. At present, Pierce is just another scientist, he claims. Besides, Patti says, universities need to challenge the industry's attitude, which he describes as: "If you do research we don't like, you're an adversary, and if you're an adversary, you're fair game." UC expects to learn whether its challenge has succeeded in a state court hearing scheduled for 8 May.

–Eliot Marshall

LIFE AND MICROGRAVITY SCIENCES

Research Drought Looms After Neurolab Mission

KENNEDY SPACE CENTER, FLORIDA—Museums in Washington, D.C., and Bremen, Germany, are already preparing to display segments from the first reusable laboratory in space, now orbiting Earth as the Neurolab mission aboard the space shuttle Columbia. Neurolab is the last scheduled flight in the 15-year-old Spacelab program, and its demise threatens to turn the business of conducting lab experiments in space into a museum piece as well: Over the next few years, until the yet-to-be-built international space station is ready for use, opportunities for such research will be few and far between.

"It's an absolutely major problem," says Mary Jane Osborn, a biologist at the University of Connecticut, Farmington, who also chairs the National Research Council's space biology panel. "If there are no flights for 5 years, the community is going to evaporate." That worry is shared by Europeans, who spent more than $1 billion to build Spacelab. "It's a very grave danger," says Guenther Seibert, chief of the European Space Agency's microgravity and space station utilization effort. "NASA doesn't have money for more Spacelab missions, and we don't have money for new payloads." NASA insists it can cobble together enough flight opportunities to tide researchers over until the station is ready. In the meantime, a debate rages over whether such expensive flights provide good scientific value for the money.

NASA

Museum-bound. The current Neurolab mission—shown here in preparation and launch—is the last scheduled Spacelab mission.

Spacelab was born in the 1970s as the European contribution to NASA's space shuttle effort and made its debut in 1983. The lab is actually a suite of hardware that fits into the space shuttle's payload bay, providing either an open pallet for experiments or a pressurized laboratory in which astronauts can conduct research. Spacelab missions have been chosen by discipline as well as by nation, with Japan and Germany flying their own wide range of experiments. Neurolab, for example, carries neurological and behavioral experiments from Europe, Japan, and Canada, and U.S. agencies such as the National Institutes of Health (NIH), the National Science Foundation, and the Office of Naval Research.

Although Spacelab was built for 50 missions, its life was cut short after NASA agreed in 1993 to work with Russia in using the Mir station for space research. That decision forced the cancellation of several missions, leaving Neurolab as its 22nd payload. Unfortunately for scientists, the aging Mir, with its constant maintenance troubles and lack of sophisticated scientific equipment, proved to be an unhappy alternative. Now an even leaner future looms, thanks to an ailing Mir that is less hospitable to science, the shuttle's preoccupation with construction of the space station, and the squeeze on the U.S. and European space programs.

NASA officials paint a somewhat brighter picture. "We're not just going to send out a bunch of pink slips when Spacelab is over," says Frank Sulzman, acting deputy director of NASA's life and microgravity sciences program. A shuttle mission is planned for later this year that includes lab space aboard a privately financed module called Spacehab, with a second flight slated for 2000. And Arnauld Nicogossian, NASA's director of life and microgravity sciences, argues that the present community of life and microgravity scientists could even expand by using sounding rockets and ground-based methods such as drop towers and parabolic airplane flights.

A major stumbling block for conducting experiments in space, however, is money. Crewed missions are notoriously expensive—

about half a billion dollars per shuttle flight. "It's costly as hell," says Simon Ostrach, a materials scientist at Cleveland's Case Western Reserve University who has flown experiments on Spacelab. "I'm not sure any scientist would say it's worth the cost of shuttle flights." Still, he adds, costs are relative. "Physicists, for example, use some pretty expensive facilities, too." Robert Park, a physicist at the American Physical Society, notes that Spacelab-related research is probably the costliest in history. "Some of the science is probably worth doing, but there is a lot of science we don't do because it costs too much."

Figuring out the value of the science done on Spacelab is not a simple matter, however. "On a cost-per-science basis, it's a pretty pricey program," says NASA adviser Norine Noonan, a former White House official and now dean of the graduate school at the Florida Institute of Technology in Melbourne. "But if you want to encourage a community, you have to provide flight opportunities."

Such efforts are needed, says Noonan, to help the life and microgravity sciences overcome their second-class status at an agency focused on astronomy and astrophysics. "They've always been the stepchild—the Cinderella without the glass slippers," she says. The agency's relationship with the outside scientific community has not been much better. "To this point, NASA's interaction with the biomedical community has been negative," says Osborn.

But missions like Neurolab are altering that perception, say some non-NASA researchers. Andrew Monjan, chief of aging neurobiology at NIH, says he's seeing a marked improvement in NASA's attitude. For example, NIH assembled a panel to review each of Neurolab's 26 experiments—the first time such a review has been conducted for a Spacelab mission, say NASA officials, and a measure of the agency's quest for scientific quality. Planned experiments during the 16-day flight range from three-dimensional rat mazes to examining synaptic connections in crickets.

Although Neurolab researchers say the data will be critical for understanding the brain, some outsiders disagree. "I'm not very impressed with the experiments I'm familiar with," says Charles Stevens, a Salk Institute neurobiologist. "The money would be much better spent on Earth." Adds another neuroscientist: "The science they're doing is unbelievably boring."

To date, NASA lacks metrics on Spacelab's accomplishments. Life and microgravity scientists will meet this fall to examine the impact of their work over the past 15 years. Although Seibert estimates that several hundred students have received graduate degrees based on work from Spacelab and that the experiments have produced more than 1000 scientific papers, even the program's supporters acknowledge that there have been no major breakthroughs. "The amount of really good science done is limited," says Osborn.

One reason, says Ostrach, is the lack of flight opportunities. "There is precious little time in space for experiments," says Ostrach, who waited for more than a decade to fly an experiment and whose son now has one on Neurolab. "We've had the total experimental time of one master's thesis." He says it is also hard to repeat and alter experiments and to publish papers based on only one data set.

NASA managers will decide shortly whether to approve a second Neurolab flight in September, a mission that would definitely be the swan song for Spacelab. With the space station not scheduled for completion until 2003, that mission looms as the start of hard times for researchers trying to hitch a ride into orbit.

–Andrew Lawler

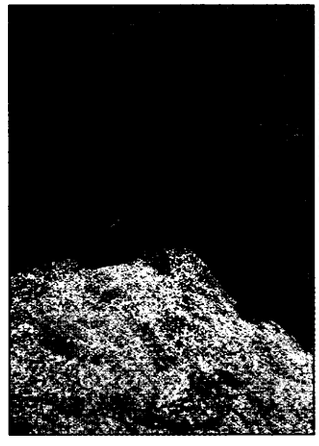
SOCIOBIOLOGY

A Blow to the 'Grandmother Theory'

When anthropologists announced a new evolutionary explanation for menopause last February, papers from the *Sydney Morning Herald* in Australia to *La Vanguardia* in Spain spread the news. The idea that it's advantageous for human females to live long after menopause so they can help feed their grandchildren—a notion taken from studies of African hunter-gatherers—captured public attention (*Science*, 25 April 1997, p. 536). But now a study of old female lions and baboons, published in this week's issue of *Nature*, challenges this "grandmother hypothesis."

Co-author Craig Packer, a biologist at the University of Minnesota, St. Paul, found that in these species, grandmothers did help feed and protect their grandchildren—but their investment had no impact on the youngsters' survival when compared to those lacking grandmothers. And loss of fertility did not boost the amount of care older lions or baboons gave to their grandchildren—in fact, only lions who were still nursing their own cubs were also able to nurse grand-cubs. In Packer's view, "menopause isn't adaptive. It has no function." Rather, it's simply a consequence of the aging of female reproductive systems.

However, the timing of menopause, Packer says, is influenced by how long mothers need to stay alive to ensure the survival of their own offspring. He and co-authors Marc Tatar of Brown University in Providence, Rhode Island, and Antony Collins of the Gombe Stream Research Centre in Kigoma, Tanzania, found that the few female baboons who survive to old age begin to lose their fertility at about age 21, then live another 5 years or so. Lions lucky enough to live until the beginning of menopause at age 14 die by age 18. The length of the interval between menopause and death, Packer says, appears to be determined by how long infants depend on their mothers: Lion cubs are vulnerable for only 1 year, so their mothers don't need to live much longer. But baboons orphaned at age 2 usually die, so a baboon mother's life-span is 5 years beyond her last pregnancy—somewhat longer than the time in which she has a dependent infant.



G. LACZ / ANIMALS, ANIMALS

Quality care? Young olive baboons may enjoy the company of grandmothers, but such care doesn't help them survive.

In humans, most children are dependent on their mothers for about 10 years and fertility begins to decline at 40. Scaling that to the numbers seen in lions and baboons, the expected life-span for women who survive into old age would be 58 to 65 years—perhaps the life-span for hunter-gatherers before modern medical care, although actual numbers are unknown. "There's no reason to stay alive to look after your grandchildren," says Packer. "Postmenopausal life expectancy is for looking after your own children."

But one of the authors of the grandmother hypothesis, anthropologist Kristen Hawkes of the University of Utah in Salt Lake City, isn't ready to concede defeat. She notes that only a few adult female lions and baboons survive past menopause—only 3.4% of lions and only 7% of baboons. By comparison, more than 80% of women hunter-gatherers live that long—and they often survive into their 70s, well beyond the decade needed to ensure their own offspring's survival. "I'm going to use these data [to strengthen my argument], because it shows we're really odd in that we live so long after menopause," says Hawkes. She says that human grandmothers, with their provisioning of weaned grandchildren, are doing "a very special kind of thing."

–Ann Gibbons