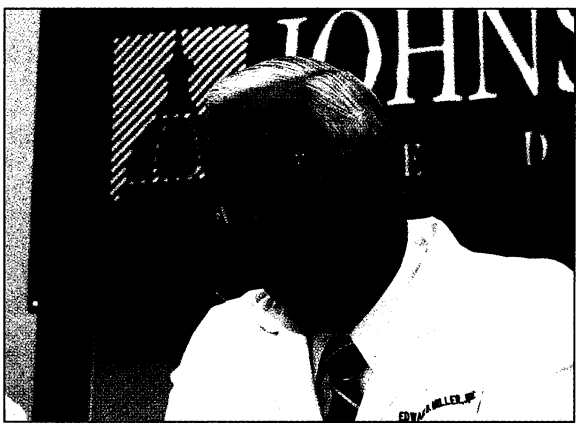
faculty. But, he added: "We accept full institutional responsibility" for the tragedy.

The inquiry concluded that the fatal reaction was probably triggered by a chemical used in the trial, hexamethonium bromide. Roche was the third volunteer to inhale this chemical; the first developed a short-lived dry cough, and the second reported no problems. Roche responded differently. The alveolar sacs of her lungs, which transfer oxygen into the blood, were irreversibly damaged. She slowly asphyxiated between 4 May, when she inhaled hexamethonium, and 2 June, when she suffered multiple organ failure.



Full responsibility. Johns Hopkins medical dean Edward Miller announced institutional changes at a press conference.

Hexamethonium blocks certain autonomic system nerves, including those controlling the airways. It was used as part of a simulated asthma episode in volunteers who were given a drug that induces asthma-like effects. More than 3 decades ago, doctors prescribed a pill form of hexamethonium to treat hypertension; that approved use ended when manufacturers withdrew the drug in the 1970s. (Its main side effect was to decrease blood pressure too much.) Clinical researchers a decade ago also gave an inhalable form of hexamethonium—similar to the one used at Hopkins—to 20 volunteers in two independent studies. They reported no ill effects. But, the Hopkins review found, the Food and Drug Administration (FDA) has never approved hexamethonium for any use by inhalation.

The report also notes that, to shorten the procedure, hexamethonium was delivered to Roche's lungs by a more powerful spray mechanism than was used for the first two volunteers. This might have resulted in a higher concentration, the report says, although "the pharmacokinetics of inhaled hexamethonium are not known, and any possible increase in lung tissue concentration in [Roche] cannot actually be verified."

Given the lack of experience with the drug, the panel examined whether the lead researcher, Alkis Togias, and the university's human safety group, the Institutional Review Board (IRB), had researched the hazards adequately. The panel found that Togias's literature review was "standard," although it failed to turn up reports of lung toxicity from 1953 to 1970 among seriously ill patients who had taken hexamethonium intravenously. But the panel faulted the IRB for lack of rigor, concluding that there was not adequate evidence for it to conclude "that inhaled hexamethonium was safe for use in research subjects."

Becker's group also noted problems in the consent form. It didn't state that inhaled hexamethonium had never been approved by the FDA or that volunteers could risk death. The panel found no evidence that Roche or other volunteers had been coerced into participating, but it disclosed that eight of the nine volunteers for the trial were employed by the Hopkins Asthma Center. When asked if employees were expected to volunteer as part of their work, Becker responded firmly that they were not. The aim of the research, Becker's panel said, was "important," and the scientific rationale was "solid."

Miller announced that Hopkins intends to add a third IRB to the two it already maintains—this one to conduct random checks of clinical trials. Plans are also under way for a stem-to-stern review of clinical operations. And all trials directed by Togias, as well as 16 others employing chemicals not approved by FDA for clinical use, have been suspended pending review. "We will have to raise the bar [for clinical research] even higher," Miller said. The next step, he added, will be to ask a panel of experts headed by Samuel Hellman, dean emeritus of the University of Chicago School of Medicine, to take an independent look. That report will go to the university's trustees "by late summer." **–ELIOT MARSHALL**

ASTRONOMY

Wet Stellar System Like Ours Found

A solar system is dying, and in its last gasps astronomers 5 light-years away can see signs that a billion comets are blazing into oblivion at once. The discovery of huge amounts of water streaming away from an aging, swollen red giant star in the constellation Leo shows that our own planetary system is not alone in harboring a key ingredient of life as we know it, researchers reported in last week's issue of *Nature*.

Scientists operating the Submillimeter Wave Astronomy Satellite (SWAS) in low-Earth orbit had no intention of getting into

ScienceScope

Brain Drain? A noted U.S. fertility researcher is relocating to England in a move that some researchers say underscores the uncertainty created by the current debate over government funding of research involving embryonic stem cells (see p. 413). University of California, San Francisco (UCSF), researcher Roger Pedersen said this week that he has accepted a job at the University of Cambridge. Pedersen, who has been working with human embryonic stem cells for several years with support from Geron Corp., will maintain ties to his laboratory at UCSF, but the lab will not move with him. "I was faced with an irresistible career opportunity and the possibility of carrying out my research ... with public support," Pedersen said in a statement.

UCSF also announced last week that Pedersen's work has been temporarily suspended until it can be moved to an off-campus building that houses no federally funded research. On 12 July, the National Institutes of Health issued a bulletin clarifying U.S. policy that derivation of embryonic stem cells, which NIH is not allowed to fund, cannot take place in a building that uses federal funds for maintenance or administration. A UCSF spokesperson said Pedersen's lab will resume its work in a new location on or before 1 August.

NSF Names Education Head Judith Ramaley, a biologist and former college president, has been named head of the National Science Foundation's (NSF's) $800 million education directorate. Her appointment last week ended 2 years of uncertainty over the direction of the foundation's second-largest—and fastest growing—segment. On 1 August, Ramaley will replace interim chief Judith Sunley, who will become a senior adviser to NSF director Rita Colwell.

Ramaley, 60, studied fertility and biological rhythms. Her administrative experience includes an acclaimed 6-year stint as president of Portland State University in Oregon and a rocky 4-year tenure as president of the University of Vermont in Burlington, which ended on 30 June. Her Vermont stay was clouded by a hazing scandal involving the men's hockey team.

Ramaley says she is looking ahead to "this marvelous opportunity to view education and training from a national perspective." Former NSF official Anne Petersen, vice president of the W. K. Kellogg Foundation in Battle Creek, Michigan, calls her "a bold, visionary academic leader, a person of action."

CREDIT: (TOP TO BOTTOM) MARTY KATZ; ADEC

el will first meet on 6 September. Afterward, "we will take as long as it is necessary to come up with the appropriate recommendations," says Sabloff. Over the next several months, he expects the group to evaluate reorganization plans proposed by Small, Smithsonian scientists, and perhaps even commission members.

Smithsonian paleontologist Brian Huber, a spokesperson for the Senate of Scientists at the beleaguered National Museum of Natural History, is not happy about the wait: "It's going to be a slow process, and we're going to be in limbo for some time." Even so, he says, the delay will be worth it if the panel "will move us in a direction we want to go."

–ELIZABETH PENNISI

GENOMICS

Animals Line Up To Be Sequenced

CHEVY CHASE, MARYLAND—The mouse was a shoe-in. After all, what other organism could better illuminate the human genome? The rat has undisputed standing as a lab staple, and the zebrafish brings a clear vision of development. But, with work on the human genome winding up in 2003, deciphering these other three will only keep the 2000-base-per-second worldwide sequencing capacity busy for so long. So it's high time to add other creatures to the pipeline, sequencers agree. With 1.7 million known species to choose from, however—and almost as many specialists lobbying for their favorites—selecting the next few will not be easy.

The stakes are enormous, researchers agreed at a workshop* here last week designed to set criteria for choosing the next candidates for the sequencing machines. If an organism is picked, its research community is guaranteed to be vibrant and well-funded long into the future. As mammalian geneticist Steven O'Brien of the National Cancer Institute put it, "Species that don't get selected will go away, and species that do get selected will prevail."

At the invitation-only workshop, sponsored by the National Human Genome Research Institute (NHGRI), four dozen researchers touted the research value of sequences from organisms as varied as swine, cats, and sea urchins. Partisans of microorganisms known as protists commandeered the slide projector to woo the crowd with a diagram showing that microorganisms constitute all but a tiny fraction of living things. Primates clearly dominated the discussion—and in this venue, at least, macaques had a home court advantage, as no chimpanzee experts were present.

Meanwhile, meeting organizers urged the group to put horse-trading aside and instead settle on criteria for deciding what to sequence next. With co-chairs David Botstein and Robert Horvitz cracking the whip, the group agreed on two sets. One they called general considerations, such as the ease of obtaining sequence and the factors that will make the sequence useful. These included small genome size, existing technical knowledge, suitability for experiments, and an active and eager research community.

The other was scientific merit—essentially, what questions a particular organism would enable researchers to explore. This was a bit more tricky, because efforts to understand human diseases or probe evolutionary relationships would demand different organisms, the group agreed. To study the evolution of traits, for example, scientists would want to sample groups in each of the major branches of life—say, a mollusk, an earthworm, and a starfish. But to develop new model systems for human neurobiology, a species closely related to humans would be more useful. Still other organisms would help researchers interpret sequence data from humans and model organisms. Although the assembled scientists outlined about 10 questions, they wisely did not attempt to rank them.

The next step in this already-contentious

Contenders. The primate community is arguing over which to sequence first: the macaque *(left)* or the chimp.

CREDITS: (LEFT TO RIGHT) RICHARD T. NOWITZ/PHOTO RESEARCHERS; RENEE LYNN/PHOTO RESEARCHERS

* NHGRI Workshop on Developing Guidelines for Choosing New Genomic Sequencing Targets, 9–10 July.

ScienceScope

Malaria Vaccine Deal An international consortium will spend $1 million to develop a vaccine against India's major cause of malaria. A U.S.-based nonprofit, an Indian research center, and an Indian biotech company this week announced that they will team up to develop a vaccine against the mosquito-borne parasite *Plasmodium vivax*, which causes nearly 65% of India's malaria cases. *P. vivax* is also widespread in other parts of the world, although it is less lethal than *P. falciparum*, the other major malaria parasite.

Under the agreement, the U.S.-based Malaria Vaccine Initiative at the Program for Appropriate Technology in Health will funnel research funds to the International Center for Genetic Engineering and Biotechnology (ICGEB) in New Delhi. Once researchers fine-tune the vaccine, test lots will be manufactured by Bharat Biotech in Hyderabad.

Prior to the deal, "we had no clear way to move this vaccine candidate from the lab to manufacturing and clinical testing," says Virander Chauhan, director of the ICGEB and head of its Malaria Research Group. Human trials are planned for late 2003.

Conflicted at EPA The Environmental Protection Agency (EPA) plans to overhaul how it seeks outside scientific advice in response to a harsh review this week by the General Accounting Office (GAO), Congress's investigative arm. The GAO report, requested by Representative Henry Waxman (D–CA), finds "limitations" in the EPA Science Advisory Board's (SAB's) procedures for reviewing conflicts of interest that "do not adequately ensure independence and balance." The lapses include not requesting sufficient information from panel members, lax record-keeping, and limited public disclosure. SAB staffers apparently failed to notice, for example, that a panelist reviewing an EPA report on whether 1,3-butadiene is a carcinogen had worked on a legal case for a manufacturer, and that others had done industry-funded research on the chemical.

SAB staff director Don Barnes says the report is "useful" rather than "damning" and insists that no panel has been biased by conflicts of interest. But he says the 100-member board is planning to adopt new procedures similar to those followed by the National Academy of Sciences. For example, Barnes's office will now invite the public to suggest panelists and comment on a proposed slate of candidates.

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