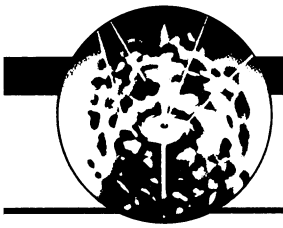


1985
A blazar is a quasar is a radio galaxy

LEAD STORY 1988
NIH: Awaiting the next director

UNDERGROUND LABORATORY

U.S. Researchers Go for Scientific Gold Mine

U.S. scientists are asking the National Science Foundation (NSF) to pour $281 million into a hole in the ground. A new research coalition last week submitted a proposal to NSF to transform one of the world's deepest gold mines into a world-class underground laboratory for physics, geology, and extreme biology. The plan is enthusiastically backed by many researchers, and a powerful member of Congress—Senate Majority Leader Tom Daschle (D–SD)—hopes to find money to get the ball rolling. But the project faces an uncertain reception at NSF, which already has a long list of expensive projects awaiting funding.

Lab advocates are also battling the clock. The owner of the Homestake Mine in Lead, South Dakota, plans to abandon the 2500-meter-deep shaft at the end of the year, leaving it for nature to flood. "This is an unusual opportunity to create the best underground laboratory ever," says physicist John Bahcall of the Institute for Advanced Study in Princeton, New Jersey, who earlier this year led an ad hoc review that deemed Homestake the best of several potential sites.

U.S. researchers—especially astrophysicists studying the origins and composition of the universe—have long coveted an underground facility deep enough to shelter sensitive instruments from unwanted cosmic radiation. But advocates failed to win funding for such a facility in the 1980s, prompting many scientists to export their studies to better subsurface labs in Japan, Italy, and elsewhere. Hopes rose anew last September, however, when Homestake Mining Co. announced that it would close its 125-year-old namesake, dug deep into the scenic Black Hills near Mount Rushmore.

Energized by the chance to snag for science the Homestake's 1000 kilometers of tunnels, electrical wiring, and extensive ventilation system, a group of researchers asked Bahcall to chair the hastily assembled ad hoc panel. It examined the potential uses of an underground lab and toured several possible sites—including an undeveloped area at California's Mount San Jacinto near Palm Springs and the Waste Isolation Pilot Plant, a nuclear waste dump in New Mexico. In March it gave Homestake the nod, noting that it is nearly twice as deep as the deepest existing underground facility, at Gran Sasso in Italy.

On 8 June, five Homestake advocates, led by physicist Wick Haxton of the University of Washington, Seattle, turned the committee's recommendation into a formal proposal. It seeks $281 million over 5 years, beginning in 2002, to carve detector halls, upgrade cables, build clean rooms, and begin small research projects. Major studies, however, would be funded separately, probably by NSF and the Department of Energy.

Treasure hunting. With support from new Senate Majority Leader Tom Daschle, researchers hope to convert a South Dakota mine into an underground laboratory.

Researchers are already proposing projects that would cost from hundreds of thousands to hundreds of millions of dollars. Biologists, for instance, are interested in relatively inexpensive studies that would examine the bacteria and other "extremophiles" that have adapted to the mine's harsh conditions. Astrophysicists say that they could install a $20 million detector designed to capture the burst of neutrinos created by a supernova. But it could take $500 million and a decade or more to build one of the biggest experiments envisioned for Homestake—the Ultra Underground Nucleon Decay and Neutrino Observatory, a bigger version of Japan's Super-Kamiokande proton-decay detector.

NSF officials say that they will soon identify reviewers to weigh the mine's merits. Even if the idea wins good notices and the approval of NSF's governing board, however, the agency will then have to slot it into a crowded lineup of already approved projects. The Bush Administration threw NSF a curve ball this year by issuing a no-new-starts diktat for the budget year that begins on 1 October. The pending projects within NSF's physics division alone include the United States' $200 million contribution to the $660 million international ALMA millimeter telescope in Chile and the $240 million ICE CUBE polar neutrino detector.

Bahcall believes Homestake "deserves a place right at the top of the list"—even though it might delay other projects he has championed, such as ALMA. "Because of the time pressure, that is the way the game has to be played," he says. But Joe Dehmer, head of physics at NSF, says his "concept is that, if approved, it will not preempt [projects] that are ready to go."

The proposal has powerful friends, including Daschle and South Dakota Governor Bill Janklow, a Republican said to be close to President George W. Bush. They see the lab as an economic and educational engine, envisioning an underground IMAX movie theater and other tourist attractions. Senator Tim Johnson (D–SD), a member of the Senate Appropriations panel that oversees NSF's budget, has already asked for $10 million next year to keep the mine open while the science bureaucracy's wheels turn. Observers say that politicians might move to earmark more funds if the project is approved.

In the meantime, Homestake's advocates are moving forward. They plan to hold a workshop next month near the historic hole to discuss what kinds of precious data the mine might yield in place of the glittering gold it once produced. **–DAVID MALAKOFF**

NAZI RESEARCH

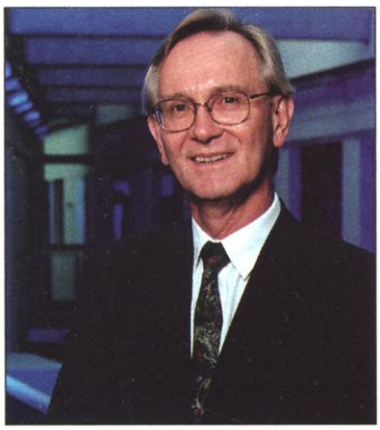
Max Planck Offers Historic Apology

BERLIN—For half a century, survivors of cruel experiments at Nazi death camps have been seeking a formal apology—as well as more details about the research abuses they endured—from Germany's scientific societies. On 7 June, a few of those victims finally got an explicit apology from the head of the country's premier basic research organization, the Max Planck Society, on behalf of its forerunner, the Kaiser Wilhelm Society (KWG), some of whose scientists were implicated in the nefarious research. However, the statement from Max Planck president Hubert Markl won't close the book on

CREDIT: CHARLES NELSON/CNA CONSULTING ENGINEERS

Nazi-era atrocities committed in the name of science: Historians are redoubling their efforts to document these activities.

Markl's historic overture came here at a symposium on human experimentation sponsored by the Max Planck presidential commission that is investigating the KWG's activities from 1933 to '45. At the opening ceremony at the Fritz Haber Institute in Berlin—a former KWG center where poison-gas research was once conducted—Markl offered eight survivors of concentration-camp experiments "the deepest regret, compassion, and shame at the fact that crimes of this sort were committed, promoted, and not prevented within the ranks of German scientists." Markl stated that "there is scientific evidence proving beyond the shadow of a doubt that directors and employees at Kaiser Wilhelm Institutes co-masterminded and sometimes even actively participated in the crimes of the Nazi regime. ... The Max Planck Society, as the Kaiser Wilhelm Society's 'heir,' must face up to these historical facts and its moral responsibility."



"For way too long, many questions were not asked ... many connections remained uninvestigated or only dealt with by outsiders."

—Hubert Markl

Markl's admission was followed by emotional speeches by two victims of Nazi physician Josef Mengele's infamous "twins" experiments at the Auschwitz-Birkenau death camp. Of an estimated 1500 sets of twins in Mengele's experiments—during which he would inject one twin with a pathogen or toxic substance and use the other as a control—fewer than 200 individuals survived the war and only about 80 are alive today. "We were used as human guinea pigs," said Eva Mozes Kor of Terre Haute, Indiana, who barely survived Mengele's abuses along with her twin sister, Miriam. Kor, founder of C.A.N.D.L.E.S., an organization of twins survivors, said she was willing to forgive even her torturers. But warning that "forgiveness erases memory," Jona Laks, an Israeli survivor who chairs the Organization of Mengele Twins, asserted that some scientists might use such clemency to forget the past. "The deeds of those who did this research cannot be forgiven," Laks insisted. "We have no 'power of attorney' to forgive in the name of the exterminated victims."

Just down the block from the conference venue is the building that once housed one of the Nazi regime's most notorious betrayers of scientific ethics: the KWG Institute for Anthropology, Human Genetics, and Eugenics. Mengele did not work for the KWG, but he had earned his Ph.D. under the institute's director, Otmar von Verschuer, who later arranged for Mengele to send blood samples from Auschwitz victims in an unsuccessful bid to find race-specific, disease-fighting proteins (*Science*, 2 June 2000, p. 1576). In addition to Verschuer's institute, Markl said, abuses were the most blatant at the Institute for Brain Research in Berlin-Buch and the German Research Institute for Psychiatry in Munich, both of which exploited Nazi pogroms to obtain the brains of mentally ill or brain-damaged people for analysis.

Molecular geneticist Benno Müller-Hill, who first detailed the Verschuer-Mengele link in his 1984 book *Murderous Science*, told *Science* that he thought Markl's apology "had exactly the right tone. It's a shame that speech wasn't given 20 years ago." Markl concedes that the apology and the ongoing KWG investigation have come late. "For way too long, many questions were not asked. For way too long, many connections remained uninvestigated or only dealt with by outsiders. And for way too long, many documents lay in the archives, inaccessible either because they remained classified, or because people were all too glad to disregard them," he said. But Markl defended the apology's timing, explaining that it followed the historical commission's interim report last fall that assembled the known evidence of KWG biomedical abuses. He also pointed out that Max Planck had previously acknowledged nefarious research at the three institutes.

"It's good to finally get this into the open," says Auschwitz survivor Vera Kriegel. She and her twin sister Olga were victims of experiments in which Mengele injected an unknown fluid into their spines. "The experiments affected our bodies and our souls," complains Kriegel, who wants to know more

CREDITS: (TOP TO BOTTOM) COURTESY OF MAX PLANCK SOCIETY; SANTOKH KOCHAR/PHOTODISC

ScienceScope

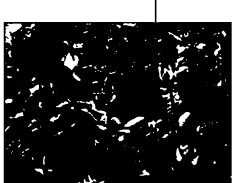
Clinical Elite Physicians will soon be given a selective invitation to join the ranks of the researchers employed by the Howard Hughes Medical Institute (HHMI) in Chevy Chase, Maryland—but only a few. In a new departure, the $13 billion institute plans to announce this week that it will spend up to $100 million to add five to 10 physician-scientists to its staff of 340 investigators. Only a handful of the current staff are doing patient-oriented research, according to HHMI. But the new program will make "a concerted effort to bridge the gap between molecular science and the alleviation of pain and suffering," says HHMI chief Tom Cech. HHMI will send letters to 119 institutions seeking nominations later this year, with applications due by 1 October. The winners will be announced next year.

Euro Advice The leaders of Europe's science academies will form a new Science Advisory Council to provide independent expert advice to policy-makers. The new council's chair, Swedish cell biologist Uno Lindberg, says that the London-based council plans to call on "Europe's best research scientists" for reports on issues "with a scientific component."

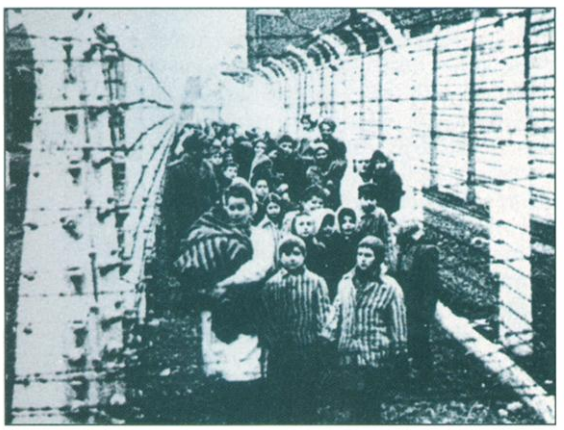
The council will soon poll European policy-makers "to define a list of potential projects," says Lindberg, the foreign secretary of the Royal Swedish Academy of Sciences, which hosted a meeting this week in Stockholm. "We also plan to take our own initiative in defining some issues."

Peter Collins, who directs science policy for The Royal Society and is currently the council's sole staffer, says it will be much leaner than the National Research Council, which conducts studies for the U.S. national academies. The group plans to meet in September to discuss possible projects and how to bring Germany—which has no national academy—into the fold.

Grafting Four of east Germany's top plant research institutes are banding together to form PlantMetaNet, a network to foster collaboration, coordinate purchases of big-ticket equipment, and attract top postdocs. The four centers—the Max Planck Institute (MPI) for Molecular Plant Physiology in Potsdam, the MPI for Chemical Ecology in Jena, the Institute for Plant Genetics in Gatersleben, and the Institute for Plant Biochemistry in Halle—plan to meet next month in Wittenberg to discuss cooperative research on plant metabolism and defense mechanisms.



about what Mengele did to her. Benoit Massin—a French historian on the Max Planck team who is trying to document more links between Mengele and KWG researchers—said he was eager for any details that she could give because "we know very little so far about the Mengele experiments involving spinal injections." Massin recently uncovered new evidence that Mengele's experiments on children's eyes at Auschwitz had been done on behalf of a scientist at Verschuer's institute. Such links are difficult to prove, because few records survived the war, and Mengele himself escaped to South America, where he died in secrecy in 1979.



Liberated from Auschwitz. Twins experiment subjects Eva (closest to nurse, front) and Miriam Mozes.

The commission is continuing to sift through whatever evidence it can turn up. Carola Sachse, a historian who heads the commission's six-researcher team, said the group is trying, for example, to gain access to more Soviet records related to the KWG and to concentration camps but has encountered obstacles. Although many documents of Nazi crimes are irretrievably lost, some survivors say that as full an accounting as possible of the misdeeds will ease their minds and, perhaps, help prevent similar atrocities in the future. "Human beings made Auschwitz," says Laks. "It was here, amongst us. And there is no guarantee that it will not return—anywhere." **–ROBERT KOENIG**

DNA SEQUENCING

Genome Teams Adjust To Shotgun Marriage

CHEVY CHASE, MARYLAND—Half a dozen reporters showed up at a meeting near Washington, D.C., on 6 June expecting to see a shootout between rival experts on genome assembly. But no one fired a shot. Instead, the scientists quietly discussed flaws in both versions of the human genome sequence—one assembled by a publicly funded consortium of 16 labs and the other by the biotech company Celera Genomics of Rockville, Maryland. The participants batted around new ideas for deciphering very large genomes, possibly by combining the best methods from both teams. The goal, said Chad Nusbaum, assistant director of sequencing at the Whitehead Institute Center for Genome Research at the Massachusetts Institute of Technology, should be to find the cheapest strategy that can also "pass the platypus test"—that is, make sense of a complex genome that's never been explored.

One reason the discussions, which were held at the Howard Hughes Medical Institute in Chevy Chase, Maryland, were calm is that the chief combatants were absent. Eric Lander, a leader of the publicly funded team and director of the Whitehead genome sequencing center, stayed away, as did Celera president J. Craig Venter. Gerald Rubin, Hughes's chief scientific officer, who hosted the meeting, said it would have been "a distraction to the press" to have them present.

For months, Lander and Venter have been trading barbs over the quality of the other team's methods of assembling the human genome sequence from raw DNA data. Lander doesn't think Celera's whole-genome shotgun assembly—an approach that relies heavily on computer power—can work without the supporting maps and other data from the public consortium. Venter, who claims his team recently reassembled the human genome sequence without using any public data, says that Celera's method works even better on its own. The public databases are riddled with vector-contaminated DNA sequence and other problems, Venter asserts.

Celera bioinformaticist Granger Sutton presented data that bolster the company's claims that its assembly method not only worked on the human genome but is improving and may be able to resolve platypus-like genomes. Sutton reported a dramatic improvement in the consolidation of human DNA sequence into "scaffolds"—Celera's term for DNA sequence that has been placed in order in large pieces but still has gaps. Celera's first draft of the genome sequence had 119,000 scaffolds; now, Sutton said, without using any public data, the company has assembled the genome sequence into just 6500 scaffolds. The "gap" area also dropped roughly in half, to 134 million base pairs. He made equally impressive claims for Celera's assembly of mouse DNA. Other speakers didn't challenge the numbers but noted that the data are not freely available and cannot be validated without a subscription.

Several others, including James Mullikin of the Sanger Centre in Hinxton, U.K., argued for a hybrid approach for deciphering genomes. Mullikin outlined a plan that would begin by quickly churning out whole-genome shotgun data, partly to give information to biologists. The early data might also help determine the prevalence of problematic repeat sequences in a species, Mullikin said: The more repeats, the more tedious clone-by-clone analysis may be required to assemble the genome sequence and identify genes. In parallel, Mullikin said, researchers should collect physical markers and build maps to help locate data along the chromosomes. "You should always build a map," because the relative cost is small, he said.

Some researchers were interested in trying to assemble genome sequences on the cheap, using a hybrid method and just a threefold depth of sequencing data. But others warned that this might not produce big enough scaffolds. Even Gene Myers, Celera's informatics chief, said, "If some projects go to 3× and stop, I'm a little worried that you won't be able to get order and orientation." Instead, he said, "you should just go to 5× and take the extra hit" in costs.

The participants seemed to agree on at least two points. First, more research is needed on "repeats," blocks of almost identical DNA sequence that appear to be 10 times more common in the human genome than in those of the fruit fly or nematode. Existing assembly programs can't handle them well and often delete them. But, argued molecular geneticist Evan Eichler of Case Western Reserve University in Cleveland, Ohio, these repeats may contain unique elements of the human genome and should not be slighted. Second, everyone wants better software for assembling genome sequences. Already, publicly funded teams at a half-dozen labs

Model organism? New methods should be able to solve the genome sequence of a genetically unmapped animal, such as the platypus.

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