a "draft" version of the human genome this year quickly tried to pour cold water on Celera's boast.

Eric Lander, for example, director of one of the largest of the publicly funded sequencing centers, based at the Massachusetts Institute of Technology, advised reporters that a lot of work remains to be done. He was quoted in *The Boston Globe* as saying that Celera had only produced "a small fraction of the data required"—less, in fact, "than has been produced by the international public sequencing consortium."

A week earlier, the public consortium had indulged in some propaganda of its own. The National Human Genome Research Institute (NHGRI) announced that the nonprofit labs had sequenced the 2-billionth base pair of human DNA. As the genome is about 3 billion base pairs long, NHGRI director Francis Collins interpreted this to mean that the job was two-thirds done. Although the milestone is impressive, researchers say, it does not give an accurate reading of how near to completion the project is.

Indeed, Venter went out of his way in testimony last week to downplay the consortium's achievements. "Mr. Chairman," Venter said, "I find myself in the peculiar position of warning you that in the race to complete a draft human sequence, the publicly funded Human Genome Project may be at a stage where quality and scientific standards are sacrificed for credit. ... Analysis of the public data in GenBank reveals that it is an unordered collection of over 500,000 fragments of average size 8000 base pairs. This means that the publicly funded program is nowhere close to being 'done.' " Venter suggested that Congress urge the consortium's researchers to "keep their standards at the highest levels ... and not rush to publish preliminary data for the sake of claiming priority."

Asked if there is any chance that the competing genome teams might still come together to finish this project, Venter said last week: "I keep trying to come to the dance, but the others are still taking lessons." This prompted a member of the public consortium to respond: "We all want to go to the dance, but we can't agree on the music." Given the harsh criticisms flying back and forth, collaboration seems unlikely.

In fact, the competition could be moving to a new arena: Celera announced last week that it is immediately directing its army of 300 sequencing machines to analyze the genome of the mouse—which is widely seen as being critical for understanding the human genome. The public consortium began a mouse sequencing project late last year. Celera expects to finish its work on the mouse long before the public consortium, which is aiming to be done by 2005. But the consortium's mouse genome will be completed to fine detail and, unlike Celera's, it will be released on public Web sites.

–ELIOT MARSHALL

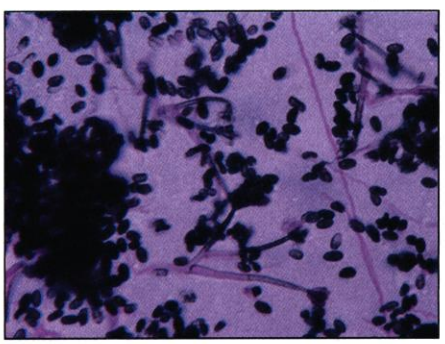
CREDITS: (LEFT TO RIGHT) LYNNE SIGLER; DEPARTMENT OF DEFENSE

PUBLIC HEALTH

A Mold's Toxic Legacy Revisited

In 1995, the Centers for Disease Control and Prevention (CDC) in Atlanta set off a cascade of alarms when an agency task force linked certain toxin-producing molds to a cluster of cases of sometimes fatal lung bleeding, or pulmonary hemorrhage, in infants. But last month, the CDC published the findings of two expert panels that identified what they called "serious shortcomings" in the initial investigation and concluded that "a possible association between acute pulmonary hemorrhage ... and [mold] exposure ... was not proven."

The reexamination is already stirring debate. Investigators involved in the original study are preparing a rebuttal of the CDC report to be posted on the Internet (gcrc.meds.cwru.edu/stachy). And resolving the issue is important, because sick infants may be just the tip of the iceberg of much broader public health problems. Toxic molds, which cause allergies and asthma attacks in sensitive individuals, have also been linked to the elusive sick building syndrome, which, in turn, has led to lawsuits and efforts to clean up mold-contaminated buildings—both costing millions of dollars.



Culprit? Uncertainty remains about whether toxic molds, like *S. chartarum*, trigger pulmonary hemorrhage in infants.

Dorr Dearborn, a pediatric pulmonologist at the Rainbow Babies' and Children's Hospital in Cleveland, triggered the original investigation in November 1994 when he alerted the CDC to a cluster of eight babies the hospital had treated for a normally rare bleeding of the lungs. The CDC immediately sent in a task force to look for possible causes. The team focused on the infants'

ScienceScope

Hit or Missile? A few well-designed balloons could burst the Pentagon's planned nuclear missile defense, according to a report issued this week by the nonprofit Union of Concerned Scientists. The controversial $7 billion system would send antimissile missiles (right) crashing into enemy warheads sailing through space (*Science*, 16 April 1999, p. 416). But an 11-member panel led by Andrew Sessler, a physicist at Lawrence Berkeley National Laboratory and former head of the American Physical Society, says adversaries could bewilder the interceptors by making modest changes to warheads.

A shroud filled with chilly liquid nitrogen, for instance, could make a warhead virtually invisible to the interceptors' heat-seeking infrared eyes, the panel predicted. Similarly, hiding a warhead inside one of a flotilla of radar-reflecting balloons would bamboozle the system. In two tests against simpler targets, the panel noted that interceptors have scored just one hit.

Pentagon planners say they will "study" the report. But shield skeptic Representative Thomas Allen (D–ME) says it demonstrates that the expensive defense "will be obsolete by the time it is deployed." The next missile test is slated for June, and the Clinton Administration could decide by October to deploy the system's first phase, which could be in place by 2005.

Policing Science Indian scientists have drafted first-ever codes of conduct for researchers and scientific institutions. The 15-point scientists' code, drafted this week by 450 researchers at a National Symposium on Ethics in the Administration of Science in Hyderabad, says researchers shouldn't "cook" results, pad their publications list, or "yield to political or social pressures." And the 16-point institutional code calls for protecting whistleblowers by creating systems that "institutionalize dissent." Conferees also recommended that the government establish an independent Office of Research Integrity to investigate misconduct.

The next step is to present the recommendations to India's Department of Science and Technology, says Pushp Bhargava, president of the Society for Scientific Values, which sponsored the conference. He and other researchers hope the agency will eventually formulate an official "Charter for Scientists."

Contributors: Robert Koenig, Erik Stokstad, Adrian Cho, Pallava Bagla

homes. "We realized that it must have to do with a home environment problem," Dearborn recalls, "because if we sent the infants home again, they restarted bleeding."

It turned out that all the houses with sick babies had recent water damage. After sampling these homes and several control houses in the same area, the investigators concluded that the likely culprit was *Stachybotrys chartarum* and other toxic molds that thrive in damp buildings and can under certain conditions produce spores containing a nasty cocktail of toxic chemicals. Although the investigators cautioned that more research was needed to prove the case, their findings precipitated a frenzy of activity. Public health guidelines were issued, contaminated buildings were evacuated and closed, multimillion-dollar lawsuits ensued—and the media jumped on the bandwagon.

But many in the scientific community felt that some questions remained unresolved. So in November 1997, then–CDC director David Satcher asked an internal working group and a panel of outside experts to review the Cleveland investigation. The groups delivered their reports last June and December, respectively, and the CDC published a synopsis in the 10 March issue of the *Morbidity and Mortality Weekly Report* (*MMWR*) (www.cdc.gov/epo/mmwr/preview/mmwrhtml/mm4909a3.htm).

Both panels spotted several flaws in the Cleveland study. For example, investigators collected twice as many samples in sick infants' homes as in control homes, and did so much more rigorously, the report states. "It's no surprise if you find more fungi in case homes this way," says Brian Shelton, a microbiologist at Pathcon, a private laboratory that specializes in building and environmental health assessments.

There was also no clear-cut clinical definition of the so-called idiopathic pulmonary hemorrhage. "The mere presence of blood, it seems, was enough to include infants as cases," says expert panel member Alan Cohen of Georgia Pediatric Pulmonology Associates, an Atlanta-based private association of pulmonologists. "But how can you define a common cause if you don't even have a defined disease?" And a statistical reanalysis of the original data indicated that the results might have been skewed by the finding of "extremely high, outlying values" for *S. chartarum* contamination of one home. This "magnified the risk about fivefold," says Daniel Sudakin, a medical toxicologist at the Veterans Administration Medical Center in Portland, Oregon.

These and additional minor problems, taken together with other evidence from the literature, led the panels to conclude that *S. chartarum*'s role in pulmonary hemorrhage was not proven. "That doesn't mean that *S. chartarum* is dismissed as a possible cause, but right now we just don't know what killed the Cleveland babies," says Cohen.

Dearborn acknowledges that because their study was designed rapidly, "it can't be perfect." But, he says, the "minor deficiencies are not enough to invalidate our conclusions." As support, Dearborn cites the fact that the number of infants with pulmonary hemorrhage has gone down recently in Cleveland—a change he attributes to public health officials inspecting homes for water damage and mold, and then having any contamination cleaned up.

Both sides do agree on one thing: Further studies are needed. "We could be missing something that is right in front of us because we think we already have the answer," Cohen says. And despite his disagreement with the *MMWR* report, Dearborn is happy the CDC is again studying the topic. "While we have continued our research efforts, the CDC stopped surveying and looking at pulmonary hemorrhage a few years ago. Now they're willing to do follow-up studies—that's great," he says.

–MICHAEL HAGMANN

U.S.–INDIA COOPERATION

Pruned Sanctions List Points to Closer Ties

For 2 years, a $500,000 scintillation counter built by Indian scientists has been sitting unused at the Fermi National Accelerator Laboratory (Fermilab) in Batavia, Illinois. The reason: U.S. sanctions, imposed after India's latest nuclear weapons tests, have prevented the team that built the device from coming to the United States to test and install it. But last week, in a development seen as a harbinger of greater cooperation between the two countries, three Indian scientists finally arrived at Fermilab to work on the equipment.

Reunited. Tata's Naba Mondal, front, works with Fermilab's Tom Diehl on the D0 detector.

CREDIT: FERMILAB VISUAL MEDIA SERVICES

After India's May 1998 tests, the U.S. government prohibited interactions between U.S. researchers and scientists at some 200 Indian institutions deemed to be part of the country's nuclear weapons and missile establishment. But on 18 March—the day before President Clinton visited India, where he declared that the bilateral relationship "was too important to ever fall into disrepair again"—the government formally removed 50 institutes from this so-called "entities list." Among them was the Tata Institute for Fundamental Research in Mumbai, which built the scintillation counter. Just 3 weeks later, three researchers from the institute arrived at Fermilab to work on the device, which is part of a massive detector called D0 (D-Zero), for Fermilab's Tevatron accelerator. Seven other Tata researchers are expected to follow in the next 6 months.

The easing of sanctions is part of a broader U.S. attempt to find areas of cooperation despite India's refusal to sign the Comprehensive Test Ban Treaty and abide by U.S. rules aimed at preventing the spread of missile and other "dual use" technologies, say U.S. officials. "It's a dual message," says one State Department official. "We acknowledge that there are differences [between the United States and India], but we say that it's time to move forward."

Indian science officials welcome the move, but say they are disappointed that an all-day "roundtable" meeting during Clinton's visit didn't open up more civilian research to joint activities. "Cooperation would be furthered if the roundtable had come up with a better and more constructive definition of dual use," says Kota Narayanan, director of the Aeronautical Development Establishment, a defense institute that remains on the banned list. "Given the imagination, anything can be classified as dual use."

For physicist Naba Mondal, the first of the Tata team to arrive at Fermilab last week, the easing of the sanctions on Tata researchers came none too soon. "It's a relief to participate again," says Mondal, who last worked at Fermilab in early 1998. His Fermilab colleagues say they are glad to have him. "We have enough other problems to solve, so it's great to have them here to work on their instruments," says Harry Weerts, a physicist at Michigan State University in East Lansing and a spokesperson for the D0 team. The detector is scheduled to be up and running in March 2001, 9 months behind schedule but still in time for the Tevatron's next set of experiments.

–JEFFREY MERVIS

With reporting by Pallava Bagla in Hyderabad.