

### TERRORISM

## Massive DNA Identification Effort Gets Under Way

At the largest crime scene in U.S. history, hundreds of police and volunteers are working around the clock, combing for victims' remains through thousands of tons of debris at the collapsed World Trade Center. A less visible but equally ambitious effort is now under way at laboratories across the country, as forensic scientists scramble to organize the largest DNA identification project in history, designed to help grieving relatives and friends bring closure to a horrific chapter of their lives.

The task of matching remains with identities following the 11 September terrorist attack poses daunting challenges, both scientific and logistic, that will test the limits of forensic DNA technology. The work requires unprecedented coordination of city medical examiners, private gene-sequencing companies—including bioinformatics powerhouses Myriad Genetics and Celera Genomics—and FBI software specialists.

Despite the huge scope of the task, forensic researchers say that quick action by New York authorities to organize the effort—the city hosted a coordination summit on 3 October—coupled with new technologies bodes well for its success. And, they add, the project could revitalize a struggling field already swamped with a huge backlog of demands for DNA testing.

The Pentagon and rural Pennsylvania crashes pose a challenge similar in scale to that of other major air disasters. One hundred and eighty-eight people were killed at the Pentagon; 44 at the Pennsylvania site. From the search-and-rescue missions—now largely completed—workers have retrieved 912 and 529 tissue and bone samples, respectively. At the Armed Forces Institute of Pathology (AFIP) in Rockville, Maryland, researchers are now trying to match those samples with

DNA collected from family members as well as from the clothing, hair, and toothbrushes of the victims. In contrast, the task facing those sifting through the rubble of the World Trade Center is unparalleled.

At the crash site, where more than 5000 dead are buried under pulverized steel and concrete, workers have so far collected roughly 5000 samples—a tiny fraction of the total expected. The intensity of the



**Missing.** Sequencing companies are helping identify victims of the World Trade Center attack.

fire, coupled with the buildings' collapse and water poured on the site, have badly degraded the remains, says Robert Shaler, New York City's forensic biology lab chief. Debris from the site is being shipped to a Staten Island landfill and spread out so trained dogs and anthropologists can search for human remains. Those samples, now mostly bone, as well as those recovered at the site, are taken to the morgue at the New York City medical examiner's building, where DNA is extracted. Nearly 100 lab staff are working in 12-hour shifts, supplemented by a large number of volunteers, says Shaler.

Once the DNA is extracted, it is shipped to Myriad Genetics in Salt Lake City, Utah,

which has worked with the New York State Police in the past and has extensive DNA identification facilities. Myriad will soon be joined by Celera Genomics of Rockville, Maryland, which will take on a hefty share of DNA processing. The New York medical examiner's lab and Bode Technology Group of Alexandria, Virginia, each plan to handle about 5% of the samples.

Meanwhile, LabCorp of Burlington, North Carolina, which specializes in paternity testing, is collecting DNA samples from relatives as well as victims' belongings that may contain their DNA. The New York State

Police lab in Albany is extracting that DNA and sending it to the companies for matching. All of the resulting data will be combined in a massive set of databases, which will use software based on the FBI's felon and population statistics programs. The companies, which are offering

their services for free or at a much-reduced cost, will assist in upgrading that software.

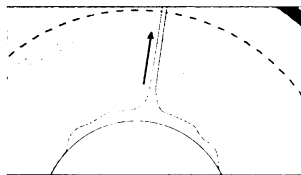
In the lab, researchers will use two techniques for matching DNA. If a cell in a sample has an intact nucleus, the job is relatively straightforward: Researchers can make a match within a few hours to 2 days. But if the nucleus is degraded by heat, pressure, or dampness—conditions that affect the New York site—they must resort to analyzing DNA from mitochondria, which can survive for long periods in protected areas of the body such as bone or teeth. "That can take 1 week to months, depending on the sample," says Demris Lee, a senior researcher at AFIP.

Even in the best hands, the tests are not foolproof. Because of natural genetic variation, one hair may yield an A in the genetic code, whereas another hair from the same person could yield a T. "There's a potential for mismatch even with one person," says Lisa Calandro, a researcher with Forensic Analytical in Hayward, California. Another problem is "contamination of one bodily fluid on another [sample]. Untangling mixed DNA," says Calandro, "is very difficult to do with sequencing."

But public and private researchers involved in past disasters are confident. "We can expect a high percentage of victims to be identified," says Kevin McElfresh, op-





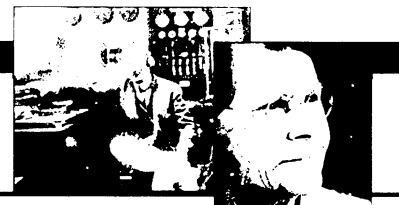


287

Did superplumes  
shape Africa?

## FOCUS

LEAD STORY 288

100 years of  
Nobel Prizes

erations vice president for Bode Technology Group in Springfield, Virginia. As evidence, he cites the successful identification of remains found in Vietnam 30 years after the war.

Each match from the World Trade Center disaster made by the private labs will be verified by the medical examiner's lab. Police then will inform families in person. Shaler says he expects the entire effort to take a year. At this stage, cost is hard to estimate, says Shaler, who notes that the city and state can draw on relief funds appropriated by Congress.

The huge task will put DNA identification in the public spotlight. Forensic scientists say they have been hampered in the past several years by lack of staff, advanced equipment, and funding. New York City alone, for example, has 10,000 samples from alleged rapes yet to be processed. The Justice Department this summer proposed spending \$30 million over the next 18 months to begin resolving the national backlog. Researchers are quietly hoping that their success in identifying the disaster victims will prove their worth and bring needed resources to their field. —ANDREW LAWLER

## THE SOVIET LEGACY

Hoping Software Will  
Help Keep the Peace

Hundreds of Russian nuclear scientists may soon find themselves writing commercial software in a novel bid to keep their weapons expertise from falling into the wrong hands. The deal, in the works for months, may herald other initiatives aimed at blocking weapons proliferation in the wake of the 11 September terrorist attacks.

The arrangement—announced in Washington, D.C., last week by the U.S. Department of Energy (DOE), the Kurchatov Institute of Atomic Energy in Moscow, and their Russian corporate partner—is salve for a bruised U.S. nonproliferation effort. In April, the Bush Administration proposed cutting \$100 million from a raft of DOE programs to improve nuclear security in Russia, from securing plutonium stockpiles against potential smugglers to

helping nuclear physicists find peaceful work (*Science*, 1 June, p. 1632). Last month's events, however, appear to have built stronger support for U.S. nonproliferation efforts. The attacks "crystallized the need to intensify cooperation" to keep weapons expertise out of terrorists' hands, says U.S. Representative Curt Weldon (R-PA), an expert on Russia.

A Russian company, LUXOFT, along with its U.S. partner CTG Inc., will take the lead in retraining the scientists, whose salaries will be paid by a \$500,000 grant from the DOE's Initiatives for Proliferation Prevention (IPP) program. Previous projects in the \$25-million-a-year IPP have typically paired U.S. companies directly with Russian defense scientists. Nevertheless, says DOE's Steven K. Black, turning weapons scientists into computer programmers "epitomizes the goal of the IPP."

The details of the Kurchatov project, which were being finalized in Moscow on 11 September as the World Trade Center and the Pentagon burned, may also help stem a decade-long decline at the institute. Its 5000 scientists, half the peak number from the 1980s, are seriously underpaid, says Boris Stavitski, a nuclear physicist who heads the Kurchatov Technopark, which seeks to commercialize the institute's research. Although fewer than two dozen scientists will be involved in the project's first phase, LUXOFT managing director Dmitry Loschinin says his firm expects to retrain 150 scientists over the next 2 years and perhaps 500 by 2006. Stavitski concedes that it will be difficult to steer some older scientists onto a new path, while others worry that such programs may fail to reach the crème of the weaponeers be-

cause the Russian government isn't ready to have its finest weapons designers shifted to civilian work.

Even so, a new day may soon dawn for many other former Soviet defense experts. The Bush Administration is expected to propose several initiatives to expand R&D collaboration and nonproliferation programs at a summit meeting next month in Moscow between President George W. Bush and Russian President Vladimir Putin. "It's a new era in our relationship," says Weldon, one that requires "a concerted effort to show Russian scientists that there are opportunities outside of weapons development."

—ROBERT KOENIG

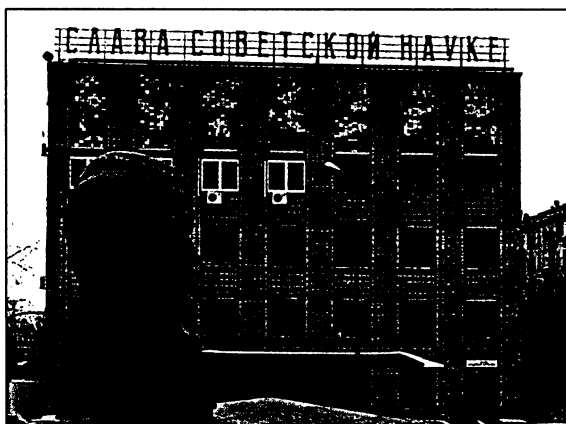
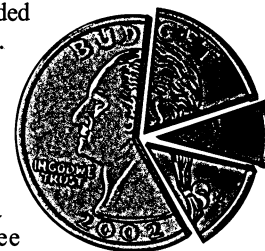
## BIOMEDICAL RESEARCH

First House Vote Good  
For NIH Budget

U.S. biomedical research spending appears headed for another big boost. Congress last week took the first step toward finalizing a 2002 budget for the National Institutes of Health (NIH) when a House subcommittee approved a 12%, \$2.5 billion increase, to \$22.5 billion, for core research programs. The panel also urged NIH to forge ahead with controversial human stem cell research, rebuffed a White House proposal to trim spending at the Centers for Disease Control and Prevention (CDC), and boosted antibiotechnology budgets.

Biomedical groups are welcoming the NIH increase, although it falls almost \$1 billion short of the amount needed to keep the agency on track to double its budget by 2003. The 2002 fiscal year began on 1 October, but Congress has given itself until the middle of the month to complete work on the 13 spending bills that direct U.S. government spending, with further extensions likely if needed.

NIH's raise was part of a larger \$123.1 billion spending bill approved on 3 October by a House Appropriations Committee subpanel. Details were not available as *Science* went to press, but lobbyists and congressional aides say the bill, which also funds labor, education, and social welfare programs, provides roughly the amount for NIH basic research requested by President George W.



**Containment.** New project will retrain 150 scientists from the Kurchatov Institute (above) over the next 2 years.

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