

retary of Health and Human Services Tommy Thompson praised Gerberding for having “the right mix of professional experience and leadership skills” to run the agency as it focuses on new infectious disease threats. The appointment does not require congressional approval. Nevertheless, Senator Edward Kennedy (D-MA), chair of the Senate panel that reviews health policy, chimed in last week that Gerberding is “a strong public health leader” and “a superb choice.”

Gerberding, CDC's first female director, appeared in televised briefings and in congressional hearings last fall to explain how the anthrax bacterium causes infection and how to guard against it. “She’s a great teacher,” says a former UCSF colleague, Paul Volberding, adding that CDC should benefit from her public communication skills. He also notes that during the 1980s and 1990s, Gerberding organized “an incredible consultation service” that worked around the clock to advise health workers and prevent the spread of HIV infection at San Francisco General Hospital.

CDC has been through a rocky period in the past 8 months, observers say, and many hope this appointment will boost morale. Some members of Congress criticized the agency for what they saw as an uncoordinated response to the anthrax mail attacks. CDC's operational response, says Tara

architecture of the CDC and its relation to the other U.S. public health agencies,” Bloom says, but it will be hard to bring order to the conflicting fiefdoms.

—ELIOT MARSHALL

MATHEMATICS

NSF to Double Number Of Math Institutes

American mathematics just multiplied itself by two. On 1 July, the Division of Mathematical Sciences (DMS) at the National Science Foundation (NSF) announced the creation of three new mathematical sciences research institutes, bringing the total number of such NSF-funded institutes to six. DMS's director, Philippe Tondeur, says he has “incredibly high expectations” for the institutes, which he describes as “vessels for start-up activities.”

The new institutes will bring together mathematicians and scientists to work on problems ranging from algebraic geometry to neuronal modeling. The institutes, chosen in a nationwide competition, are the Mathematical Biosciences Institute (MBI) at the Ohio State University, Columbus; the Statistical and Applied Mathematical Sciences Institute (SAMS), a consortium led by Duke University in Durham in collaboration with North Carolina State University in Raleigh, the University of North Carolina, Chapel Hill, and the National Institute of Statistical Sciences in Research Triangle Park; and the AIM Research Conference Center (ARCC) at the American Institute of Mathematics in Palo Alto, California. They join the Mathematical Sciences Research Institute at the University of California, Berkeley; the Institute for Mathematics and Its Applications at the University of Minnesota, Minneapolis; and the Institute for Pure and Applied Mathematics at the University of California, Los Angeles. MBI and SAMS will each receive \$10 million from NSF over the next 5 years; ARCC is slated for \$5 million.

MBI will kick off with a yearlong program on neuroscience, including neuronal modeling of olfactory, auditory, and sensory-motor systems. “The mathematical sciences proved valuable in completing the genome project,” notes MBI director Avner Friedman. “The promise of the future is even greater.” SAMS has programs lined up on statistical aspects of environmental model-

ing and inverse problems. ARCC is to hold workshops on specific problems—the first, scheduled for December, will focus on algebraic geometry—and create a permanent “workshop Web site network” for each.

“We’re at an exciting juncture,” says Tondeur, who is stepping down as director of DMS this month after overseeing a dramatic 70% increase in NSF math funding over the past 3 years (from \$106 million in 2000 to \$182 million budgeted for 2003). Mathematics institutes are a “very



Castle on a hill. The American Institute of Mathematics' Research Conference Center in Morgan Hill, California, will host focused workshops.

low cost” way of bringing people together for focused research, he says.

—BARRY CIPRA

VIROLOGY

Active Poliovirus Baked From Scratch

With mail-order DNA and more than 2 years of painstaking work, researchers for the first time have assembled a virus from its chemical code. The lab-built poliovirus killed mice and was almost indistinguishable from the original. Biologists disagree on how difficult it would be to construct far bulkier viruses such as smallpox to create bioweapons.

Scientists hail the research, described online this week by *Science* (www.sciencemag.org/cgi/content/abstract/1072266), as a technical achievement. But in an age when anthrax travels through the mail, few could avoid the paper's obvious implications, both for polio—a disease that once triggered panicky epidemics and is now nearing global eradication—and other viral diseases. “It is a little sobering to see that folks in the chemistry lab can basically create a virus from scratch,” says James LeDuc, director of the Division of Viral and Rickettsial Diseases at the Centers for Disease Control and Prevention in Atlanta. Vincent Racaniello, a virologist at Columbia University in New York City, was more blunt. “Poliovirus,” he says, “will never be gone.”

A genomic runt at just 7741 bases, poliovirus is composed of a single strand of RNA and ranks among the most thoroughly dissected viruses of all time. Once it infects



Inside choice. Julie Gerberding advances from science chief to director of CDC.

experienced in the real world, and she knows the CDC as an insider.” James Curran, a former CDC epidemiologist who is now dean of the Rollins School of Public Health at Emory University in Atlanta, agrees: “She will be an energetic leader for CDC at a time when concerns about bioterrorism and infectious disease are paramount.” But others, such as Barry Bloom, dean of the Harvard School of Public Health in Boston, warn that any insider like Gerberding faces a big challenge. “It is time to reexamine the

Gerberding is “a terrific appointment,” says O’Toole: “She has great scientific credentials, she’s

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a cell, the RNA translates itself into a large protein, which is then cleaved to produce a cluster of smaller ones. Those proteins attack critical cells such as neurons in the central nervous system.

The researchers—Jeronimo Cello, Aniko Paul, and Eckard Wimmer of the State University of New York, Stony Brook—built an almost perfect replica of the virus, reading the recipe available in a public database of the letters that make up the virus's chemical code. Because RNA is chemically unstable, the scientists converted the RNA sequence to DNA, replacing every uracil base with a thymine. Then they ordered short stretches of carefully arranged bases from one of the many companies that churns out such piece-meal DNA. Cello took about a year to layer these fragments together to form the first third of the virus. Once he established that these stretches stayed oriented correctly, he hired a DNA synthesis company to assemble the remaining portion, which it did in 2 months. To distinguish the synthetic virus from natural strains, the group inserted 19 markers, minor mutations that weren't expected to alter polio's behavior.

DNA in hand, the researchers immersed it in enzymes to convert it back to the RNA at polio's core. The artificial poliovirus acted much like its natural counterpart: It multiplied, and antibodies could block it from entering cells. Mice injected with the synthesized virus became paralyzed after about a week, as did animals infected with normal poliovirus. But the artificial version was less lethal: Between 1000 and 10,000 times more virus was needed to kill an animal. The team suspects that one or more of the 19 markers are hobbling the virus.

The research might throw a wrench into polio eradication plans. "It erodes the underpinning of the whole eradication concept," says Peter Jahrling, a smallpox researcher at the U.S. Army Medical Research Institute of Infectious Diseases in Fort Detrick, Maryland. Last month the World Health Organization (WHO) announced that it had erased

the disease from the European continent, and, according to Bruce Aylward, WHO's coordinator of the Global Polio Eradication Initiative in Geneva, "the goal is to stop immunization" once the disease is fully eradicated. But given the possibility of recreating the virus, researchers who favor continued immunization, such as Donald A. Henderson, an adviser to the U.S. government on bioterrorism policies, hope that WHO will reconsider its stance.

Then there's the question of whether one could reconstruct other pathogens whose sequences are publicly available. Smallpox, among the most feared bioterror agents, is far more massive than polio at 185,000 bases and far more complex. LeDuc, for one, doesn't believe that rebuilding it is imminently doable. But given the new results, others aren't so sure. "In principle, yes, [it's] possible to synthesize smallpox," says Vadim Agol, a virologist at the Russian Academy of Medical Sciences in Moscow.

Despite such nightmarish scenarios, scientists have no plan to stop posting new genetic sequences online. Wimmer says that no concerns were raised to him about publishing the paper. As Cello says, "By releasing this you alert the authorities ... [about] what bioterrorists could do."

—JENNIFER COUZIN

EMBRYONIC STEM CELLS

Stem Cells Not So Stealthy After All

Human embryonic stem (ES) cells get no free pass from the immune system, contrary to some researchers' early hopes. As the cells differentiate, they express increasing levels of the telltale tags the body uses to distinguish between native and foreign cells. The findings, published online this week by the *Proceedings of the National Academy of Sciences*, confirm that a patient's immune system would be likely to reject transplanted tissues derived from ES cells. Scientists hoping to use the cells to treat Parkinson's disease, diabetes, and other maladies will therefore have to find ways to reconcile the body's defense system with the transplanted cells.

Earlier evidence from human embryos raised the slim but tantalizing possibility that ES cells might be "immune privileged," unrecognizable by the body's defenses against foreign cells. One study reported that the embryo cells that give rise to ES cells do not express the so-called MHC proteins that help the immune system identify an invader; another produced inconclusive results. That led some researchers to hope that transplanted tissue derived from ES cells might remain under the radar of the immune system.

Although the new results are not unexpected, they lay that hope to rest, says Hugh

Pasteur Loses A French civil court has found the Pasteur Institute in Paris to be responsible for a woman's death last year from Creutzfeldt-Jakob disease (CJD). Pascale Fachin contracted the brain-wasting disease in 1985 from contaminated human growth hormone (HGH) prepared by Pasteur scientists (*Science*, 31 May, p. 1587). The Montpellier court in southern France ordered Pasteur and the endocrinology group Association France-Hypophyse to pay nearly \$800,000 in damages to the family of the 30-year-old Fachin, half of it immediately.

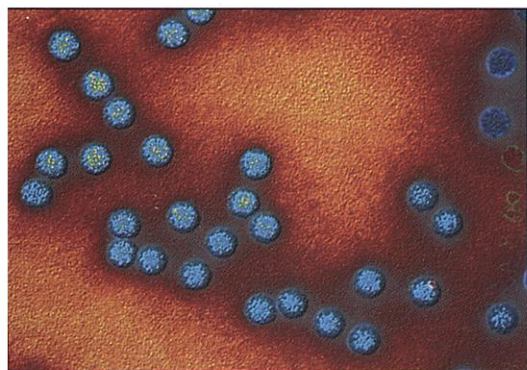
The institute plans to appeal, arguing that it could not be responsible for the contamination because it was "of a biological nature." The institute's insurance company has refused to cover the damages because it considers Pasteur to be the producer, not supplier, of HGH—a question the court ruling does not resolve. A defeat at the appellate level could unleash a flood of similar claims against the institute from other families of CJD victims.

Space Fantasy Russia's space industry has fallen on hard times since the breakup of the Soviet Union. And even its former competitors, the United States and Europe, are scrambling to pay for current projects such as the international space station. But last week, Russian officials made headlines around the world when they said that they have begun talks with European and U.S. space officials on a 2015 flight to Mars involving a six-person crew.

Nikolay Anfinov, R&D director of the Institute for Machine Building, and Vitaly Semenov, head of the Rosaviakosmos Keldysh Center, laid out a proposal for a 440-day flight—and a 2-month tour of the Red Planet—at a Moscow space conference. They estimated that the mission would cost a mere \$20 billion. If true, that would be a real bargain, as the U.S. Apollo project cost \$100 billion in deflated, 1960s dollars.

Not surprisingly, Western officials are skeptical. "NASA has received no plans or proposals," says one agency official, who adds that Russia has enough trouble meeting its obligations for the space station without bankrolling a trip to another planet.

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According to plan. Poliovirus reconstructed from its genetic sequence is indistinguishable from the original, shown here.

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