tion," says Varmus. "[Zerhouni] will need to work out with [NIAID director Anthony] Fauci where it's going to be invested."

Another looming task is finding top-quality institute directors. Varmus recruited several talented people, such as Hyman and Gerald Fischbach, head of the National Institute of Neurological Disorders and Stroke, who have since moved on. Six directorships—of the imaging, mental health, neurology, mental health, general medical sciences, and alcohol abuse institutes—are or will soon be vacant. "The recruitment process is hard," Varmus says.

In the larger picture, the new NIH director will be expected to explain the importance of bench biology to a public that hungers for cures. The race to sequence the draft human genome "made it a little easier," says MIT molecular biologist Phil Sharp, a member of the National Cancer Institute advisory board. But explaining how those discoveries will help vanquish disease is a huge challenge, he adds.

Edward Benz, president of the Dana-Farber Cancer Institute in Boston and former chair of medicine at Hopkins, thinks that Zerhouni is up to the task. "Varmus is a hard act to follow," he says. "But I think [Zerhouni] has all the tools to do it. He has the intellectual capability, he's an outstanding manager and consensus builder, he's extremely fair, and he has a lot of integrity."

–JOCELYN KAISER

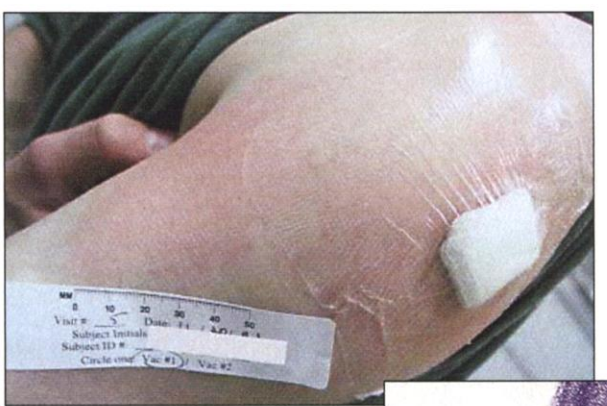
SMALLPOX VACCINES

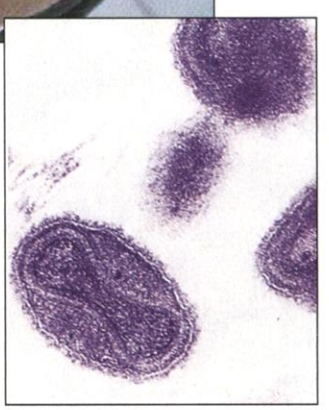
New Cache Eases Shortage Worries

Since 11 September and the spate of anthrax attacks, the U.S. government has been scrambling to prepare for an even worse scenario: a bioterrorist attack with the variola virus, the cause of smallpox. Now, the nation can breathe a little easier. A new study has found that the 15.4 million doses of aging smallpox vaccine currently in the U.S. stockpile—an amount considered woefully inadequate—can be safely diluted by a factor of 5 or 10 without losing their potency. And, in another unexpected windfall, Aventis Pasteur, the vaccines business of Aventis Pharma with U.S. headquarters in Swiftwater, Pennsylvania, has just announced that it plans to donate to the government about 85 million additional doses of a similar vaccine that have been stored in its freezers for about 40 years.

Although the Aventis vaccine still needs to be tested for safety and efficacy, "this ratchets back our anxiety meter quite a bit," says Peter Jahrling, a smallpox researcher at the U.S. Army Medical Research Institute of Infectious Diseases in Fort Detrick, Maryland.

The Aventis vaccine may offer the U.S. government an extra "insurance policy" until new vaccines are ready for use, Tommy Thompson, secretary of the Department of Health and Human Services, said last week. Last November, the U.S. government placed a rush order for 155 million doses of a brand-new smallpox vaccine with a British-U.S. company called Acambis—in addition to the 54 million doses it had ordered from Acambis a year before. Clinical trials with the Acambis vaccine started last month; the entire batch is to be delivered before the end of 2002.





Shot in the arm. Dilutions of the smallpox vaccine, administered to volunteers (*top*), appear to be just as protective against the smallpox virus (*right*).

The dilution studies were launched last fall. The National Institute of Allergy and Infectious Diseases (NIAID) funded Sharon Frey and her colleagues at St. Louis University to test whether Dryvax, the vaccine currently in stock, could be stretched to protect more people if needed. Wyeth produced the vaccine, an attenuated virus called vaccinia, before routine smallpox vaccination was halted in 1972.

The study of 680 volunteers, released online last week by *The New England Journal of Medicine*, showed that more than 97% of the participants who received undiluted vaccine developed a "take"—a localized skin infection at the site of the shot, known to reliably indicate protection. So did 100% of those in the group given a vaccine diluted fivefold and 99% of those who got a 10-fold dilution. The slight variation in numbers, the researchers suspect, probably means that some of the volunteers were vaccinated earlier in life.

Few people knew of the cache of old vaccine in Aventis's freezers until *The Washington Post* reported it last week. But Aventis Pharma CEO Richard Markham denied that the company recently "discovered" the supply, as the *Post* reported. The company knew about the vaccine, which had been produced at the request of the U.S. Department of Defense, all along, he says, and had in recent years discussed with the government what to do with it. But the issue was never urgent—until last fall, when the company offered the vaccine to the government for free.

The company, which is hoping to be reimbursed for repackaging and other costs, has transferred the vaccine—stored in about 60 2-liter bottles at –20°C—into standard vials containing about 100 doses each. Like Dryvax, it consists of a vaccinia strain dubbed "New York City Board of Health." Thompson says the government decided to keep the huge cache a secret while awaiting the results of preliminary tests of the vaccine's viability and potency. Those test tube experiments, completed recently, suggest that the vaccine is about as potent as Dryvax, the company says.

NIAID will test the Aventis vaccine in human volunteers over the next 6 to 8 weeks. Researchers will also test whether it can be diluted, like Dryvax. If so, the U.S. government could soon have more than half a billion vaccine doses at its disposal, more than enough for the country's 286 million residents.

With the acute shortage most likely solved, the government also plans to address the needs of millions of infants, the immuno-

CREDITS: (TOP TO BOTTOM) S. E. FREY *ET AL., N. ENGL. J. MED.* 346,1265 (2002); CDC

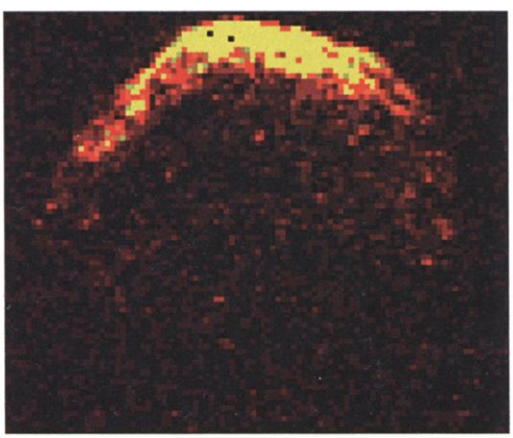
compromised, and eczema patients—groups at high risk of serious side effects from the current vaccines. Several companies, including Aventis, are already working on the next-generation, much more attenuated, vaccines.

–MARTIN ENSERINK

IMPACT HAZARD

Celestial Billiards Threaten Hit in 2880

The first master of gravity, Isaac Newton, saw the solar system as a clockwork machine whose workings depend solely on the mass of the machine's parts and thus their gravitational pull. Would that it were so. On page 132 of this issue, a team of researchers reports that the 1-kilometer asteroid 1950 DA has up to a 1-in-300 chance of clobbering Earth with a 10,000-megaton punch on 16 March 2880. For an event 878 years hence, that may seem like a relatively precise prediction. But if basic Newtonian mechanics were the only consideration, there would be little room for doubt. A pivotal uncertainty, it seems, is how the asteroid spins.



Destination Earth? The 1-kilometer asteroid 1950 DA—"imaged" here by radar—could be on a collision course with Earth, depending on an uncertain interaction with sunlight.

As its temporary name implies, astronomers discovered 1950 DA 52 years ago, but they lost track of it when it faded from view before anyone determined its precise orbit. Unknowingly photographed in 1981, it was finally snared for good on New Year's Eve 2000 in an automatic telescopic search for threatening asteroids. Celestial mechanicist Jon D. Giorgini of the Jet Propulsion Laboratory in Pasadena, California, and 13 colleagues then calculated—based on telescopic and subsequent radar observations—that it had up to a 1-in-300 chance of gravitationally caroming off 15 close encounters with Earth and Mars to hit Earth in 2880. That probability is 1000 times greater than the well-determined impact probability of any other sizable known object. It's also 1.5 times the combined impact probability of all other asteroids.

But sources of potentially significant uncertainty remained, notwithstanding orbital observations spanning 51 years, high-precision radar data, and an orbit-stabilizing gravitational interaction between Earth and the asteroid. The tidal pull of the galaxy varies; the sun's gravity weakens as the sun blows off mass; its slightly squashed shape creates an irregular gravity field; estimates of planets' masses are uncertain; and sunlight exerts a gentle push. Combined, says Giorgini, these uncertainties could make 1950 DA cross Earth's orbit as much as a few days before or after the 20-minute window when a collision is possible in 2880.

But the killer uncertainty is the so-called Yarkovsky effect (*Science*, 13 August 1999, p. 1002). A century ago, the Russian engineer I. O. Yarkovsky recognized that the "afternoon" quadrant of an asteroid—the side most thoroughly heated by the sun—could act like a little rocket as it rotated into dusk and early evening, emitting thermal radiation that could push the asteroid into a different orbit. But astronomers know so little about 1950 DA—especially the direction of its spin axis—that celestial mechanicists can't tell what direction its Yarkovsky "rocket" points. The probability of impact could be higher than calculated—or it could be zero. Gauging the future path of an asteroid "is a lot like shooting billiards," says Giorgini. Given 1950 DA's 15 close planetary encounters before 2880, "we're trying to line up a 15-bank shot. We can do the first 12 really well. For the last three, we need to know more about the cue ball" and how much the Yarkovsky effect will influence its course.

No one in the planetary science community is panicking. "The work is done about as well as it can be," says planetary dynamicist William Bottke of the Southwest Research Institute (SRI) in Boulder, Colorado, but "it's a long time away, and the probability is small."

Small, but the biggest around, notes Bottke's SRI colleague, asteroid specialist Clark Chapman: "It looks to me [like] there's a good chance that for the next 30 years this will be the one to watch." If the threat continues to grow, one solution could be as low-tech as dusting 1950 DA with soot or powdered chalk to power up or throttle back the Yarkovsky effect (as well as sunlight pressure) and steer the asteroid away from Earth. Or just plastic-wrap it in reflective Mylar by sending a sunlight-driven solar sail on a collision course with the asteroid. Such tinkering with his clockworks would stun Newton.

–RICHARD A. KERR

CREDITS: (LEFT TO RIGHT) J. D. GIORGINI *ET AL.*/JPL; JSC/NASA

ScienceScope

Privacy Rule Revised Biomedical research groups are welcoming revisions to a patient confidentiality rule that they feared would paralyze research. On 21 March, the Department of Health and Human Services (HHS) proposed several changes to the so-called Privacy Rule, which goes into effect in April 2003.

Most important for researchers, HHS this month is seeking suggestions on what data should be stripped from records so that they can be shared with scientists. HHS had planned to remove so many identifiers—such as zip codes and birth dates—that the records would have been useless, say researchers (*Science*, 7 December 2001, p. 2070). HHS also wants to simplify patient consent forms for sharing data.

Jennifer Kulynych of the Association of American Medical Colleges says that although her group still has concerns, "we're very encouraged."

Tough Task A Nobel Prize–studded panel held its first meeting this week to tackle NASA's troubled life and materials sciences program. Led by Columbia University neurobiologist Rae Silver, the task force was put together by NASA Administrator Sean O'Keefe to study how to maximize scientific returns aboard the shrinking space station.

The 20-member panel boasts two Nobel Prize winners, but scientists close to the station program are skeptical that it will have an impact. Money woes, they note, will severely restrict station science for the foreseeable future. But Silver says O'Keefe gave the panel free rein to propose the best science, regardless of budget. Its final report is due in June.

Imported Embryos French research minister Roger-Gérard Schwartzenberg has jumped the gun on proposed changes in France's bioethics laws that would authorize human embryo research. Last week, Schwartzenberg announced that he intends to allow French scientists to import embryonic stem cell lines from other countries where such research is permitted, such as Australia and the United Kingdom. The new bioethics law has already passed a first reading in the National Assembly, but Schwartzenberg acted after noting that the lengthy parliamentary process meant that scientists "risk having to wait" until 2003 to get cells.