against top officials and, possibly, some workers at the plant.

The 30 September incident at a nuclear fuel processing facility 110 kilometers northeast of Tokyo began when workers inadvertently set off a nuclear chain reaction by dumping a mixture of uranium oxide and nitric acid into a settlement tank, creating a critical mass of uranium. Three workers were hospitalized and more than 60 others, including three rescue workers and seven golfers on a neighboring course, were found to have been exposed to high levels of radiation. In addition, 81 nearby residents were evacuated for 2 days and more than 300,000 people in the vicinity were told to stay inside for 24 hours. The runaway chain reaction was halted after 18 hours. Early reports of an explosion that released radioactive material were false, officials said, and radiation levels quickly returned to normal outside the plant once the reaction ceased.

The most critically ill of the workers, Hisashi Ouchi, 35, was exposed to about 17 sieverts of radiation, according to the Science and Technology Agency's National Institute of Radiological Sciences in Chiba, near Tokyo. A sievert is a measure of the total radioactive dose that factors in each kind of radiation received and its energy. Normal background radiation produces a dose of about 2 to 4 millisieverts annually, and doses of more than 5 sieverts have typically been fatal.

Ouchi was scheduled to receive blood stem cells from his brother in a first-ever procedure for radiation victims aimed at restoring his lymphatic cells, white blood cells critical to the body's immune system. Hisamaru Hirai, a cell transplant specialist at the University of Tokyo Hospital, where the procedure will take place, says the stem cell transplant promises to restore Ouchi's blood-generating capability more quickly than a bone marrow transplant. He notes that only two of the 23 people exposed to high doses of radiation at Chernobyl and given bone marrow transplants survived for any length of time.

The treatment was developed as a nonsurgical alternative to bone marrow transplants for those undergoing cancer therapy. The donor is given a growth factor for several days before the procedure to boost the number of stem cells in the blood. Hirai says the second victim, who received 10 sieverts of radiation, has received a transfusion of blood stem cells drawn from a newborn's umbilical cord because of the absence of a suitable donor. A third worker, who received 3 sieverts, was not in critical condition.

The plant, operated by Tokyo-based JCO Co., converts uranium into uranium oxide, purifies it, and forms it into pellets. The pellets are then sheathed in a thin metal cladding to form the fuel rods that go into a nuclear reactor. The procedure that went awry involves dissolving powdered uranium oxide in nitric acid to remove impurities. The workers mixed the uranium oxide and nitric acid in a steel vessel, instead of a specialized mixing column, and transferred the mixture to a sedimentation tank using open buckets and a funnel rather than a device designed to transfer the material and automatically control the amount of solution in the tank. They also overloaded the tank with 16 kilograms of uranium, seven times the approved amount. The fuel was intended for the country's experimental fast breeder reactor, which uses more highly enriched uranium than a commercial nuclear plant.

A cooling system surrounding the sedimentation tank prolonged the reaction until workers were able to drain the water from the system. For good measure, they then added 30 liters of sodium borate, which absorbs neutrons, to the sedimentation tank.

–DENNIS NORMILE

CHEMISTRY

Possible New Anti-Inflammatory Agent

Mammalian cells generate superoxide radicals when they convert food into energy or when they fight microbes, but excessive amounts of these highly reactive molecules are cellular killers. They contribute to the tissue damage in many inflammatory conditions, including arthritis, and to the "reperfusion" injury that occurs when blood flow is reestablished to tissues that have had their supply cut off—when clot-busting drugs are used to treat a heart attack or stroke, for example. Now, clinicians may have a new weapon to counter superoxide's damaging effects.

Normally, the body protects itself against superoxide by deploying a family of enzymes called superoxide dismutases (SODs), which transform superoxide into molecular oxygen and hydrogen peroxide before it can wreak its havoc. Indeed, SODs themselves once looked like promising candidates to treat inflammatory conditions such as rheumatoid arthritis. But they triggered adverse immune reactions in some patients and, like other proteins, native SODs are rapidly broken down by the body's many protein-destroying enzymes.

On page 304, however, a team led by pharmacologist Daniela Salvemini and chemist Dennis Riley of MetaPhore Pharmaceuticals in St. Louis reports that a small nonprotein mimic of SOD that they previously identified reduces tissue damage in animal models of inflammation and reperfusion injury. The new compound, a 15-membered ring that contains five nitrogens, is not the first nonprotein SOD mim-

ScienceScope

Hot Potato Britain's simmering debate over the safety of genetically modified foods is about to boil over again. Biochemist Arpad Pusztai says *The Lancet* on 16 October will feature part of his controversial study on the effects of genetically modified potatoes on rat guts. The Rowett Research Institute in Aberdeen, Scotland, suspended Pusztai last year after he announced that the potatoes stunted the animals' growth (*Science*, 19 February, p. 1094). The journal declined to comment, but executive editor David McNamee confirmed in *The Independent* that publication was imminent.

The study, hailed by activists but panned by the biotech industry and a six-member Royal Society panel, hadn't been published before. Pusztai, who is now retired, says it went through three rounds of peer review, yet he is bracing for a firestorm: "The rubbishing brigade is already out," he says.

Transparent Victory The U.S. government planned to publish a rule this week clearing the way for anyone to demand raw data gathered by federally funded researchers and used to support agency policy. The hotly debated regulation, hammered out in response to a law passed last year, closely follows a draft OMB proposal tailored to meet the concerns of universities and agencies. Researchers, for example, would be able to withhold private and proprietary data (*Science*, 20 August, p. 1189).

George Leventhal, an analyst at the Association of American Universities, says his group is pleased with OMB's narrow interpretation. But he predicts it will be challenged in court by industry groups. The rule goes into effect early next month.

Arima Out Japan's science community lost a champion this week when Akito Arima, a physicist and former president of University of Tokyo, was removed as minister of Education, Science, Sports, and Culture in a cabinet reshuffle. "I don't think there is anyone [in politics] who knows science and technology like Arima," says Akiyoshi Wada, an official at the Institute of Physical and Chemical Research (RIKEN) outside Tokyo. Arima's successor is Hirofumi Nakasone, a businessman and son of the former prime minister. The 69-year-old Arima, who served for 14 months, will retain his seat in the Diet and vows to keep pushing for university reforms. He also pledges to "continue to work to increase the budget for science and technology."

Contributors: Martin Enserink, Jocelyn Kaiser, Dennis Normile

ic researchers have identified, but it is more specific in its action than the others. "They've taken a prototype drug and shown that it has therapeutic activity in animals," says John Groves, a chemist at Princeton University.

To come up with their compound, the MetaPhore team started with manganese, the least toxic of the three metals that can perform SOD catalytic activity. By trial and error, the researchers produced a ring structure that holds onto manganese reasonably well. Then, by computer modeling and with many animal tests, they developed a derivative that was even more stable and more effective in breaking down superoxide. This compound, known as M40403, transforms superoxide at rates similar to those of native SOD, and without acting on other related compounds such as peroxynitrite. In addition, it proved stable when injected into animals, indicating that the compound itself, and not a breakdown product, produces any pharmacologic effects. "M40403 is excreted intact," says Riley.

The investigators then tested whether M40403 would protect animals against the kind of damage thought to be caused by superoxide. In one set of experiments, they induced inflammation in the footpads of rats by injecting them with the polysaccharide carrageenan. M40403 injections given 30 minutes before the carrageenan greatly decreased several key indicators of inflammation such as swelling, tissue damage, white blood cell accumulation at the site of the injury, and production of certain cytokines, immune regulators that contribute to the damage.

In another series of tests, the researchers evaluated M40403's effects on perfusion injury. They used clamps to shut off blood supply to the intestines of rats for 45 minutes, and then released the clamps to allow the blood to flow. Such rapid restoration of circulation produces a spike of superoxide radicals as the tissue goes into high metabolic gear to make up for its previous lack of oxygen. The resulting damage killed most of the control animals within 2 hours and none survived more than 4 hours, but about 90% of the treated animals lasted that long. Analysis of blood and tissue samples again showed that M40403 reduced the typical signs of inflammatory damage.

Salvemini says the team hopes to conduct safety studies and then determine whether the compound has therapeutic value in humans. But no matter what, she adds, because M40403 is very specific in its actions, it should at least be possible to use it to dissect out which of the many changes contributing to inflammation are due to superoxide. "This compound will help [researchers] discover and deconvolute this very difficult-to-untangle set of interactions of these very short-lived, very reactive molecules," says Groves. Indeed, the MetaPhore team's results have already indicated that superoxide is involved in the regulation of cytokines. "That's important," says Matthew Grisham, a biochemist at Louisiana State University Medical Center in Shreveport. "No one has made that connection before." –EVELYN STRAUSS

GENOMICS

Mouse Genome Added To Sequencing Effort

Even as the largest academic genome sequencing centers scramble to generate a rough draft of the human genome by March 2000, they have taken on another monumental task: producing a preliminary sequence of the mouse genome sequence by 2003, followed by a high-quality version 2 years later. On 5 October, the National Human Genome Research Institute (NHGRI) awarded $21 million over the next 7 months to jump-start the mouse effort at 10 laboratories across the United States with a total of $130 million to be spent through 2002 (see chart). The initial amount "was less than what we might have hoped for," says NHGRI director Francis Collins, which is why the grants of all groups but one are for 7 months. But NHGRI wanted the groups to ramp up quickly. "I'm so tickled to be able to start the mouse [sequencing] now," says Collins.

MOUSE GENOME GRANTS (1999–2002)

Principal Investigator	Institution	Amount (in millions)
John D. McPherson	Washington Univ. School of Med.	$24.642
Richard A. Gibbs	Baylor College of Medicine	$22.344
Eric S. Lander	Whitehead Inst. for Biomedical Rsrch.	$21.507
Eric Green	Natl. Human Genome Research Inst.	$16.060
Douglas R. Smith	Genome Therapeutics Corp.	$12.874
Bruce A. Roe	Oklahoma University	$12.192
William R. McCombie	Cold Spring Harbor Laboratory	$6.874
Raju S. Kucherlapati	Albert Einstein College of Medicine	$6.127
Robert B. Weiss	University of Utah	$6.067
William C. Nierman	The Institute for Genomic Research	$1.60 (1 yr)

SOURCE: NHGRI

Both human and mouse geneticists share that sentiment. At an estimated 3 billion bases, the mouse genome is comparable in size to the human's and is sometimes described as the human genome chopped into 150 pieces and put back in a different order along the mouse's 21 chromosomes. Because the mouse is so well studied, its sequence will speed the understanding of how our own genes work, says mouse geneticist Barbara Knowles, director of research at the Jackson Laboratory in Bar Harbor, Maine. And Richard Gibbs, whose sequencing center at Baylor College of Medicine, Houston, was one of the big winners, agrees: "To ensure that we can interpret the human sequence with maximum efficiency, there's nothing quite like the mouse genome," he says.

The three centers that pulled down the biggest grants for what will be known as the Mouse Genome Sequencing Network are those doing the lion's share of the U.S. contribution to the human genome sequence: Baylor and the Whitehead Institute for Biomedical Research in Cambridge, Massachusetts, each received $4 million while Washington University School of Medicine in St. Louis got $2.7 million. The three centers will have help, however, from a cadre of teams including some that are relatively new to large-scale sequencing.

Genome mappers Raju Kucherlapati, a geneticist at Albert Einstein College of Medicine in New York, and NHGRI genomicist Eric Green have both signed on to the mouse effort. "We've never had support for sequencing in the past," says Kucherlapati, whose group has only about 1 million bases of sequence from various organisms under its belt, "but it was a natural evolution from mapping." Over the next 7 months, he expects to complete about 12 million bases of the rough draft, while Green, who has done some sequencing, hopes to do 25 megabases over the next year.

Unlike the Human Genome Project, in which the sequencers took on entire chromosomes or parts of chromosomes, those tackling the mouse genome will do a mix of randomly chosen DNA and DNA of biological interest, such as regions in which the mouse genes are in the same order as those in regions of human chromosomes that contain disease genes. The network will meet at the end of the month to choose those regions and decide how mouse researchers can request that regions containing genes they are interested in be sequenced first. Says Kucherlapati: "If the consortium can move top priority mouse projects along [with the sequencing], that will be a great strategy." –ELIZABETH PENNISI