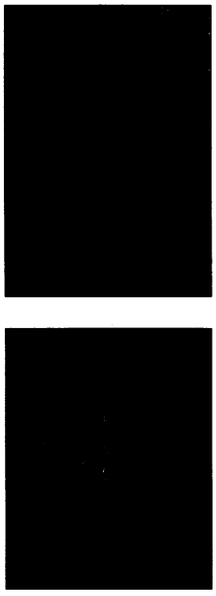
widely used lab strain—designated CD-1—essentially unperturbed.

The findings raise concern about whether current animal tests adequately gauge the human health risks that hormone mimics may pose. The new findings "may have significant implications," says reproductive biologist Earl Gray of the Environmental Protection Agency's (EPA's) health effects lab at Research Triangle Park, North Carolina. CD-1 has been the mouse of choice, he says, for studying hormone mimics. If CD-1 mice prove insensitive to such compounds, adds reproductive biologist Frederick vom Saal of the University of Missouri, Columbia, then "these are the last animals you'd want to use" for testing. Researchers caution, however, that they have not yet determined whether the animals show the same range of sensitivity to hormonelike chemicals as they do to the real McCoy.



Impervious to estrogen. Sperm flourish at center of tubule in testis of CD-1 mice *(bottom)*, but not in other strains *(top)*.

Jimmy Spearow, a reproductive geneticist at the University of California, Davis, says he first uncovered strain-to-strain differences in hormone sensitivity in the late 1980s. Then a few years ago, he got a surprise when reading papers on the physiological effects of hormonelike chemicals in mice. "I said, 'Oh my God, they're using the most resistant strains!' " Spearow recalls. To probe further, he and colleagues implanted estrogen plugs under the skin of juvenile male mice from four strains. The capsules released doses of 17β-estradiol ranging from 0.2 to 2.0 micrograms per gram of body weight for 3 weeks.

At the lowest dose, mice from the most sensitive strain, B6, developed testes that weighed 60% less than those of control animals. In CD-1 mice, however, the same dose reduced average testis weight by just 10%. Similarly, the numbers of maturing sperm dropped precipitously at the lowest doses in sensitive strains. CD-1 mice implanted with twice the amount of estrogen necessary to stop sperm production in other strains still produced roughly 90% of normal levels of maturing sperm. Overall, the researchers report, other strains are about 16 times more sensitive to estrogen than CD-1 mice.

The findings are intriguing in part because CD-1 mice have been bred to produce large litters. Spearow speculates that the physiological factors responsible for fruitful parenthood have rendered the mice relatively impervious to outside estrogens. Indeed, after breeding two strains—S15/Jls and C17/Jls—over some 70 generations, the one Spearow selected for large litter size, S15/Jls, was less sensitive to estrogen than was the other strain. "It's a biologically plausible hypothesis," says Gray, who thinks breeding for litter size "is certainly going to affect the reproductive system somewhere."

The new data suggest to vom Saal at least that "the risk assessment process substantially underestimates variability in animal populations." Wild variation could undermine the fudge factor built into animal tests to protect human health: When setting safe exposure levels for people, researchers take the dose found to be safe in lab animals and divide it by a factor of 10—to account for variability from person to person—before setting a permissible exposure level. But the gulf between CD-1 and the most estrogen-sensitive strains is so great, vom Saal says, that it overwhelms the safety factor. "If mice have a substantial potential [genetic] variation in response to estrogen," he asks, "why shouldn't one assume an equal amount of variability in response to hormones in humans?"

Regulatory agencies plan to take no chances. The EPA is now standardizing a test battery and screening procedures that its labs, starting in about 2 years, by law must use to evaluate tens of thousands of chemicals for hormonelike activity. Says Gary Timm, senior technical adviser in EPA's office of science coordination and policy, "Certainly we're interested in using the most sensitive species or strains." **–LAURA HELMUTH**

CREDITS: (LEFT PAIR) SPEAROW *ET AL.*; (RIGHT) K. OSF RINGLAND/ANIMALS, ANIMALS

ASTRONOMY

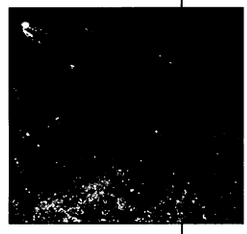
A World With Two Suns

Buried in the unusual twinkling of a star near the center of our galaxy, an international team of astronomers has uncovered the first evidence of a planet orbiting two stars at once. If other observers can confirm it, the Jupiter-sized planet will be more than an astronomical novelty. Its detection, which the Microlensing Planet Search collaboration describes in a paper posted on the e-print server at Los Alamos National Laboratory (xxx.lanl.gov/abs/astro-ph/9908038), will become a triumph for a new and potentially powerful technique for finding planets around other stars.

Extrasolar planets are too dim to be seen directly. The several dozen detected so far have betrayed themselves by tugging their

ScienceScope

Mongrel Salmon? Salmon genes are back in the spotlight. Two conservation groups last week filed suit in Washington, D.C., to force the federal government to list Maine's few remaining Atlantic salmon as endangered, charging that a 2-year-old voluntary plan to protect the fish doesn't go far enough. Less than 100 salmon returned to seven Maine rivers last year to spawn, down from at least 20,000 a century ago.



The suit—which joins similar complaints filed earlier by other groups—could force a replay of a scientific tussle. In 1997, federal officials declined to list the Maine fish, in part because genetic studies suggested that they were not "distinct" enough from nearby Canadian runs to merit protection under the Endangered Species Act (*Science*, 6 February 1998, p. 800). State officials—who fear listing could force restrictions on timber harvesting and farming—insist the fish are mongrels produced by inbreeding with stocked fish and don't deserve listing.

But new studies "undermine the state's position," says Steve Moyer of Trout Unlimited in Washington, D.C., which is suing along with the Atlantic Salmon Federation. Salmon science is expected to go on trial this fall.

Compelling Enough? Scientists have come up with 10 reasons for restarting the Fast Flux Test Facility, which has been idle since 1993 (*Science*, 4 April 1997, p. 28). But politicians hope the arguments won't sway Energy Secretary Bill Richardson, who must decide by next month whether to spend as much as $400 million to bring the nuclear research reactor back to life.

Earlier this month, a DOE advisory panel said the Hanford, Washington, facility—part of Pacific Northwest National Lab—had 10 potential uses, including fusion and materials research, and urged Richardson to begin an environmental study of its restart. But opponents, including lawmakers from nearby Oregon, are concerned that it might add to Hanford's serious environmental problems. Heartened by Richardson's rejection last year of a plan to use the reactor to produce tritium gas for nuclear weapons, they now hope "he kills it once and for all," says an aide to one Oregon senator.

Contributors: Michael Baker, Jocelyn Kaiser, David Malakoff

parent stars back and forth, creating a small, oscillating signal in the starlight. That technique, however, is sensitive only to massive planets—otherworldly Jupiters. But Einstein's General Theory of Relativity points to another, potentially more sensitive, way to find planets. Every concentration of mass—star or planet—bends the four-dimensional fabric of space-time. "It's like putting a bowling ball on a mattress," explains co-author Andrew Becker, an astronomer at the University of Washington, Seattle. Just as the path of a marble curves as it rolls past the bowling ball, he says, light itself bends when it passes near a star or planet.

This effect comes into play when a dim star in our galaxy passes almost directly between Earth and a second star, something that happens "about once per star per few hundred thousand years," estimates astronomer Penny Sackett of the Kapteyn Institute in the Netherlands. The gravitational field of the intervening "lens" star bends and magnifies light from the background star, a process called gravitational microlensing. By observing tens of millions of different stars every night, several search teams are now regularly observing this telltale stellar brightening, which reveals clues to the nature of the intervening lens object.

When a single star acts as the lens, the background star simply brightens and fades, but a binary star has an irregular gravitational field that creates a pattern of bright and dark regions, "kind of like the bright lines at the bottom of a pool" in sunlight, says Becker. Such complicated twinkling "has been observed many times in the past several years," says Sackett, "and in each previous case, a good model was produced with a simple two-lens system." And then along came MACHO-97-BLG-41, which had an exceptionally odd twinkle.

Within 10 days of its discovery on 19 June 1997, by the Massive Compact Halo Object (MACHO) survey team, astronomers realized that the flickering of MACHO-97-BLG-41 was too complex to result from a single-star lens. The Microlensing Planet Search collaboration began monitoring the 100-day-long event in collaboration with MACHO and the Global Microlensing Alert Network. At first astronomers thought they might have detected a planet around a single star (*Science*, 8 August 1997, p. 765). But they now report that accounting for this star's fluctuating light requires a binary system and a third object—a planet weighing three times as much as Jupiter and orbiting at about 7 astronomical units (1 AU is equal to the separation of Earth and the sun) from the two stars. "We have several hundred data points," says Becker, "and they constrain this model very well."

"It's a pretty nifty result," says University of California, Berkeley, astronomer and fellow planet-hunter Geoff Marcy, "but the architecture of the system is quite odd," which makes him wonder whether the planet is real. He and other astronomers say the spinning binary, with its stars just 1.8 AU apart, could create "gravitational chaos" near the hypothesized planet, perhaps flinging it from the system. But Harvard astrophysicist Matt Holman, who has used a computer to simulate how a planet around a binary star would behave over millions of orbits, says that the planet is "most likely stable. ... The planet is far enough away that it should feel the two stars as if they were one."

All the same, astronomers would like independent confirmation. A second team, the PLANET collaboration, also monitored MACHO-97-BLG-41 but is still analyzing the data. "We have a lot of extremely good data, and we see quite a bit of structure," says Space Telescope Science Institute astronomer Kailash Sahu, a PLANET member, "but we don't yet have a complete solution."

If their analysis confirms the planet, "it will add an exclamation point to the suspicion that planets can orbit outside binary stars," says Marcy. And although this planet is much larger than our own, he says, its discovery would be a boost for a technique that may ultimately detect another Earth. **–MARK SINCELL**

Mark Sincell is a writer in Houston.

CREDIT: LOS ALAMOS NATIONAL LABORATORY

CHINA SPY INQUIRY

DOE Blames Three At Los Alamos Lab

Department of Energy (DOE) Secretary Bill Richardson last week recommended that the former director of Los Alamos National Laboratory and two other officials be disciplined for bungling a spy investigation. The move has prompted speculation that Richardson is looking to deflect blame from DOE headquarters, and it has placed a spotlight on the lab's contractor, the University of California (UC), which must formally discipline the officials.

Responsible? DOE fingers ex-director Hecker.

Richardson handed down his verdicts on 12 August, declaring that a new report on the incident by the department's Inspector General "makes it clear that DOE political and career management failed to give necessary attention to counterintelligence and security. ... There was a total breakdown in the system and there's plenty of blame to go around." Congressional investigations and internal DOE reviews revealed that a 3-year investigation into suspected espionage at the lab, which focused on computer scientist Wen Ho Lee, was crippled by a host of errors. They include a failure to look closely at suspects other than Lee and communication lapses that allowed the Taiwan-born researcher to have access to classified information for months after he was supposed to be moved to a less sensitive position. Lee, who was fired in March, has denied the spying allegations and has been charged with no crime.

Richardson did not name names in releasing excerpts from the classified report (home.doe.gov/news/releases99/augpr/pr99213.htm) but said that 19 people at Los Alamos and DOE's Washington headquarters played roles in the Lee investigation. In only three cases, however, was the evidence of mismanagement "sufficiently strong" to warrant disciplinary action. Congressional sources told *Science* and other media that the trio fingered by the report consisted of metallurgist Sigfried Hecker, who directed Los Alamos from 1986 to 1997 and still works there as a scientist; Robert Vrooman, a retired chief of counterintelligence at the lab who now works for an outside contractor; and Terry Craig, another former counterintelligence officer still employed at the lab.

Hecker is accused of "failing to follow through on" a DOE request to limit Lee's access to classified information, while Vrooman reportedly allowed Lee to remain in a sensitive position even after Federal Bureau of Investigation agents told him in October 1997 that the suspect could be moved without endangering the investigation. Craig was cited for botching a file search for a waiver that Lee had signed that would have allowed agents to search his desktop computer. While Hecker has not commented on the charges, Vrooman told *The Washington Post* this week that the case against Lee "was built on air" and that Lee was targeted largely because of his race.

As *Science* went to press, Los Alamos lab director John Browne had not yet decided on the punishments. UC officials say it could be a week or more before they fully review the classified report, which UC President Richard Atkinson discussed with Richardson during a 10 August meeting in Washington.

Some of Hecker's colleagues at Los Alamos say their former director is being asked to shoulder more than his share of the blame. Noticeably absent from Richardson's hit list, says one weapons researcher who asked not to be identified, were any DOE headquarters staff. "This makes it look like all the problems were out here, and nobody in D.C. made any mistakes," he says.

–DAVID MALAKOFF