the very heart of the planet, as now seems likely, then the circle will be closed: Earth's surface not only sinks into the depths but deep rock feeds the surface, offering scientists another window into the planet's deepest depths.

–RICHARD A. KERR

TRANSGENIC ANIMALS

Fertility Therapy May Aid Gene Transfer

The premillennium frenzy about cloned drug-secreting sheep and cows, or pigs that have been given human genes in hopes of using them as organ donors, tends to gloss over the fact that introducing foreign genes into animals other than mice is still very difficult. Because current techniques—which primarily involve injecting DNA directly into fertilized eggs—have only a modest success rate, costs can soar to more than $300,000 for a single cow carrying a foreign gene. Now, genome tinkers may have a new tool for beefing up animal genomes with exotic DNA: sperm.

On page 1180, embryologists Anthony Perry, Teruhiko Wakayama, and Ryuzo Yanagimachi of the University of Hawaii School of Medicine in Honolulu and their colleagues report that they have used sperm to transfer a foreign gene into mice. The technique is a modification of a method originally developed by Yanagimachi for injecting sperm into eggs that is now standard for in vitro fertilization of human eggs. About 20% of the mouse pups born in the group's experiments carried the transgene—which is "definitely on the high side of what's done routinely," says George Seidel, a reproductive physiologist at Colorado State University in Fort Collins. Adds embryo physiologist Gary Anderson of the University of California, Davis, "If this works in other species, people will jump on it like a banshee."

For some this is a giant "if," however. Reproductive biologist James Robl of the University of Massachusetts, Amherst, describes the technique as "very interesting." But he adds, "I'm not sure how widespread its applicability will be." He and others note that before the mouse work, the sperm injection method, known as ICSI for intracytoplasmic sperm injection, had been shown to work well only in humans.

Researchers have been trying to use sperm to create transgenic animals for about 10 years. In early experiments, they simply mixed the DNA to be transferred with sperm and used the mixture for in vitro fertilization. Although the technique initially appeared to work, Anderson says, "even leading people in the field haven't been able to repeat the original result." Today, there seems to be general agreement that such sperm-mediated gene transfer succeeds, but with highly variable efficiency.

About 2 years ago, Perry decided to take a quick shot at seeing whether Yanagimachi's ICSI method would do better. The researchers first removed the propellant tails from sperm and subjected the sperm heads to freezing or detergents to disrupt their cell membrane. They then mixed the sperm heads with a gene encoding green fluorescent protein (GFP). To inject this mixture, the team used a so-called piezoelectric device, which drives the tiny injection pipette very fast and precisely into mouse eggs.

Compared to the manual injection devices used in human fertility clinics, piezoinjection seems to be far less disruptive for the egg. "The mouse egg is the most fragile of [all species]. This study would have been impossible without the piezodevice," says Robert Wall, a geneticist at the U.S. Department of Agriculture's Agricultural Research Service in Beltsville, Maryland.

When the researchers injected the GFP gene along with untreated sperm, only 26% of the embryos carried the transgene. But it was present in up to 87% of the early embryos produced by the detergent-treated or frozen sperm—as indicated by the embryos glowing green under an ultraviolet lamp. Ultimately, however, only about 20% of the newborn pups that developed from the injected eggs carried the GFP gene. Perry suspects that GFP has a deleterious effect on embryonic development, so the transgenic fetuses tend to be selectively aborted. Whatever happens, a majority of the animals that end up with the transgene trans-

Greening up. These mouse embryos glow green under ultraviolet light *(right)* because they acquired the gene for green fluorcescent protein along with injected sperm.

CREDITS: PERRY *ET AL.*

ScienceScope

Clinical Clampdown A member of the U.S. biomedical elite—Duke University's Medical Center in Durham, North Carolina—was ordered to freeze most of its clinical research this week. Duke University stopped enrolling new patients in government-sponsored studies after receiving an order to halt from the Office for Protection from Research Risks (OPRR), which is part of the Department of Health and Human Services.

OPRR officials could not be reached for comment, but Duke disclosed in a statement on 11 May that OPRR has been asking the university since December to bring its procedures into line with OPRR rules. Among other things, OPRR has asked Duke to keep more extensive records and create a second review panel to monitor a growing number of clinical trials. Duke offered some changes in March and April. But OPRR, displeased with "the scope and pace of [Duke's] implementation of corrective actions," suspended patient enrollment in government-sponsored trials on 10 May.

Duke's chancellor for health affairs, Ralph Snyderman, says "hundreds" of studies will be disrupted. University officials "absolutely were not" prepared for OPRR's order, he says, adding that it "would be an understatement" to say it took them by surprise. "From our perspective," Snyderman says, "I don't believe any patient was put at risk," but he is satisfying OPRR's requirements and hopes to get clinical research on track in a week.

Pulling Up Their Genes France's genome research may soon get a big boost. The government is considering plans to pump an additional $330 million over the next 3 years into a gene research complex in the Paris suburb of Evry, according to a report this week in *Le Monde*.

The extra spending is reportedly driven by worries that the French genome program is being left behind by major investments in gene research in the United States and the United Kingdom. Officials hope that by following suit, France will get its share of potentially lucrative genome patents.

Officials at Génopôle—which includes the national gene sequencing center and several corporate labs—were not available for comment as *Science* went to press.

a different way."

While that debate rages on, researchers are jumping on other avenues opened by the Vanderbilt team's findings. They "tell us something new and important about what the visual system can do," says Newsome. And that, adds Heeger, "opens up the opportunity for trying to measure and understand the underlying neural basis. Immediately you think, 'What is it that the neurons are doing; what is the neural code for this?' " A number of labs, he says, are sure to design experiments to search for that neural code.

–MARCIA BARINAGA

PLANETARY SCIENCE

Asteroids Form Rocky Relationships

A run-in with a huge asteroid is bad enough, as movies like *Deep Impact* have made all too graphic. Now there's a scenario for the next round of threat-to-humanity movies: double impacts. Sightings of asteroids with companions—the latest of them just reported on the Web—are convincing astronomers that such pairs are far from rare.

Indirect evidence, such as paired impact craters on Earth, had already hinted that asteroids sometimes come in pairs. In the late 1970s, some astronomers watching stars blink out as asteroids passed in front of them reported extra flickerings that might have been caused by companions—although colleagues remained skeptical (*Science*, 17 July 1987, p. 250). The first direct proof that asteroids can have moons of their own came when the Galileo spacecraft flew by 56-kilometer Ida in 1993 and photographed tiny Dactyl, a 1.5-kilometer body orbiting about 100 kilometers away. And now astronomers observing from the ground have detected a much heftier companion around the 214-kilometer asteroid Eugenia.

Double trouble. A pair of asteroids traveling together created Clearwater West (36 kilometers in diameter) and East craters in northern Quebec 290 million years ago.

CREDIT: (TOP) NASA/JPL/CALTECH; (BOTTOM) NASA

In a meeting abstract newly posted to the Web (scorpio.tn.cornell.edu/ACM/web_abs.html), astronomer William Merline of Southwest Research Institute in Boulder, Colorado, and his colleagues report that they spotted a 15-kilometer satellite orbiting about 1200 kilometers from Eugenia. Eugenia and its satellite are a single fuzzy spot of light in an ordinary telescope, but late last year, in the course of a 200-asteroid search for satellites, Merline's group was able to separate them with the 3.6-meter Canada-France-Hawaii Telescope (CFHT) on Mauna Kea, Hawaii. The CFHT was equipped with an adaptive optics system that precisely undoes the blurring effects of atmospheric distortion (*Science*, 27 June 1997, p. 1994).

More candidates for binary asteroids are emerging from observations of the pulsating brightness of asteroids that pass near Earth. Most asteroids reflect varying amounts of sunlight as they rotate because of their irregular shapes, but a half-dozen so-called near-Earth asteroids (NEAs) observed by Petr Pravec of Ondrejov Observatory near Prague and his colleagues and by Stefano Mottola of the DLR in Berlin flicker as if one body is periodically passing in front of or behind another perhaps twice its size. Although the Eugenia observations are "pretty hard evidence" for a satellite, says astronomer Alan Harris of the Jet Propulsion Laboratory in Pasadena, California, the light variations of at least a couple of the NEAs are "highly suggestive."

As satellites of asteroids have proliferated, theoreticians have been trying to explain how they formed. After Dactyl was spotted near Ida, some suggested that the pair came together after a collision shattered a precursor body into a swarm of smaller asteroids, and a larger fragment managed to capture a smaller one gravitationally. But no one has tested this idea with detailed calculations. Noting that smaller collisions may have turned many other asteroids into rubble piles, William Bottke of Cornell University and Jay Melosh of the University of Arizona, Tucson, suggested another scenario in 1996: Earth's gravity, they said, could split a rubble-pile asteroid in two if it passed nearby.

Eugenia's satellite is more perplexing, says Melosh. Although Merline calculates

ScienceScope

Rocket Science Troubled by a string of commercial and military launch failures, NASA is reexamining its own unmanned rocket program. Over the last 9 months, the Defense Department and communications companies have lost billions of dollars worth of satellites to flawed lift-offs, including three in one recent 8-day span. Although NASA has a mostly unblemished record with its single-use rockets, space agency officials last week delayed the launch of a weather satellite and ordered a review of dozens more scheduled unmanned science flights.

The review "is an extra precaution," says a NASA engineer. "We'd like to stay out of the headlines." He doesn't expect the extra look—which could be finished by next month—to cause delays for scientists with space-bound projects.

Digging In After nearly 30 years of skirmishes among developers, archaeologists, and government officials, France has taken a big step toward regulating "rescue archaeology." Culture minister Catherine Trautman last week unveiled a plan to end what she calls the "quasi-permanent crisis" by creating a new agency to oversee the excavation of ancient remains threatened by development projects.

Last year, archaeologists went on strike to derail a plan to open such projects to competitive bidding, saying it would damage research (*Science*, 16 October 1998, p. 407). But now, scientists are mostly welcoming a proposal to replace a semiprivate archaeological contracting agency with a public entity under the culture and research ministries. Plans to involve government and academic researchers in projects are an "affirmation that rescue archaeology is a scientific activity and a public service," says Françoise Audouze of the Center for Archaeological Research in Nanterre.

But one archaeologists' union is unhappy with a complicated formula that will exempt small developers from paying for digs. It is calling for changes before the government presents the plan to Parliament this fall.

Contributors: Eliot Marshall, Michael Balter, David Malakoff