area near Georgia's breakaway Abkhazia region to help local officials grab the dangerous, portable devices.

Georgia is a hot spot for illicit trafficking of nuclear materials (*Science*, 1 June 2001, p. 1632). Although Western governments have worked hard to help Russia and other countries secure their fissile material, the 11 September attacks have heightened fears of terrorists using other radioactive materials, from discarded medical isotopes to uranium mining tailings, to make "dirty bombs" that could spread radioactivity over large areas. Feeding those fears is the fact that the materials are usually less secure than weapons-grade nuclear caches and often have been abandoned by former owners.

The crisis began with a fax on Christmas Eve from Georgian authorities. Three men gathering wood near Lja on 2 December 2001 had found two containers that appeared to have melted the nearby snow. Lugging the containers back to their campsite for warmth, the men soon became dizzy and nauseous and started vomiting. Within a week, radiation burns began to develop on their backs. On 4 January 2002, IAEA dispatched three investigators to Tbilisi, but heavy snows and rough terrain prevented them from reaching the objects.

This is not the first time such containers have been found. In 1998, not far from Lja, a fisherman found one in a riverbed. Physicists in Tbilisi later discovered that it was packed with strontium-90 emitting a whopping 40,000 curies of radiation, equivalent to the radiation from strontium-90 released during the 1986 Chornobyl explosion and fire. "My shock was so great when I was informed of this," says Abel Julio González, director of IAEA's division of radiation and waste safety. "I was convinced they had made a mistake." But an IAEA team confirmed the readings and whisked the object —along with a second one found soon after—to a guarded location in Tbilisi.

Western officials initially did not know what the containers were used for nor how many had been built. A request for information from Russia yielded sympathy but few answers, says an IAEA official, as Russian authorities insisted they were not liable for nuclear materials found in other former Soviet republics.

Slowly, however, González and his team began to piece together the puzzle. They obtained a schematic of a device that used the mystery containers to generate electricity from the strontium's heat, possibly to power remote radio transmitters. The units recovered so far are encased in a titanium-based ceramic. As the beta particles streaming from the strontium-90 slam into the metal shielding, part of the energy is converted into x-rays and part into heat. Soviet labs apparently produced several hundred of the generators, including some with radioactivity levels as high as 100,000 curies. None of these high-powered models have yet turned up, and only a handful of the 40,000-curie devices have been recovered in covert operations in four countries: Georgia, Belarus, Estonia, and Tajikistan.

Radiation injuries from orphaned sources are "a very real problem," says George Vargo of the U.S. Pacific Northwest National Laboratory in Richland, Washington. But the Georgian men being treated for severe x-ray burns are the first confirmed victims of the Soviet thermogenerators.

The IAEA team members had planned to wait until this month to assist in recovering the containers, but they decided to move more quickly after an urgent appeal last week from the Georgian government. They arrived in Tbilisi on 27 January. Officials from IAEA and Georgia, France, Russia, and the United States are expected to meet in Tbilisi on 4 February to review the recovery effort and discuss the lingering threat of other orphan sources. Although much of the strontium-90 will probably be stored as radioactive waste, the agency is also mulling a suggestion to sell some of it to hospitals as a source of the short-lived daughter isotope yttrium-90, an experimental treatment for cancer and arthritis. **–RICHARD STONE**

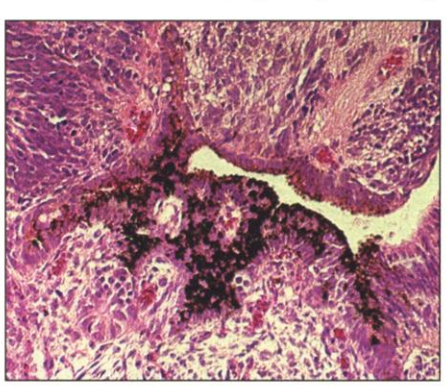
CREDITS: (TOP TO BOTTOM) DENIS DOYLE/AP; J. CIBELLI *ET AL.*

STEM CELL RESEARCH

Primate Parthenotes Yield Stem Cells

A reproductive quirk of some reptiles, insects, and other species may help stem cell researchers sidestep ethical debates over the use of human embryos. Researchers at Advanced Cell Technology (ACT) in Worcester, Massachusetts, report on page 819 that they have isolated the first stem cell lines from primate parthenotes, embryos grown from unfertilized eggs that, in mammals, are not capable of developing into viable fetuses.

In October, Yan-Ling Feng and Jerry



Virgin division. Nerve (pink) and pigment (black) cells grow from stem cells plucked from a parthenote.

ScienceScope

FMD Free It's official: The foot-and-mouth disease (FMD) epidemic that ravaged British farms in 2001 is over. Last week, the International Epizootic Office in Paris declared the U.K. free of the dreaded virus, clearing the way for resumed meat exports. The total number of animals slaughtered to subdue the virus, according to the Department for Environment, Food, and Rural Affairs: 6,131,440.

W.'s Other War The Bush Administration appears to be more sympathetic than the Clinton team to the cause of veterans with Gulf War illness, a mysterious set of symptoms plaguing some veterans of the 1991 conflict. Based on as-yet-unpublished research, the Department of Veterans Affairs announced in December that Gulf War vets face double the risk of Lou Gehrig's disease—marking the first time an Administration has acknowledged a direct link between the war and a specific disease. And last week, Secretary of Veterans Affairs Anthony J. Principi named several vocal critics of past government policy to a new research advisory committee. In contrast, a Clinton-era oversight panel was heavy on military brass and widely mistrusted by veterans (*Science*, 2 February 2001, p. 816). Epidemiologist Robert Haley of the University of Texas Southwestern Medical Center in Dallas, one of the Clinton-era critics and a member of the new panel, says, "We're seeing a complete reversal of policy."

Cloning Bills Blossom A looming Senate debate over cloning got a little more complicated last week. Senator Tom Harkin (D–IA) threw a third major proposal for banning human reproductive cloning onto the table, giving lawmakers preparing for an expected vote later this spring even more to think about.

The new bill (S. 1893) is similar to S. 1758, proposed last December by Senator Dianne Feinstein (D–CA). Her bill would keep the door open for research using cloned embryos but impose civil penalties on anyone who tries to clone a person. Harkin's bill adds criminal penalties to the mix.

More than 20 research organizations have endorsed Feinstein's bill over legislation backed by Senator Sam Brownback (R–KS) that would ban all uses of cloned embryos. The next step: March hearings on Brownback's bill (S. 790), with a full Senate vote coming sometime later.

Hall of the Institute for Reproductive Medicine and Genetics in Los Angeles showed they could derive stem cells, which later developed into neurons, from mouse parthenotes. Then in November, ACT scientists grabbed headlines with the news that they had created human parthenotes—although the cell clusters died before reaching the blastocyst stage, well before viable stem cell lines could be extracted.

Now Jose Cibelli and colleagues at ACT report that they have been able to culture a variety of cell types, representing all three germ layers, from stem cells taken from monkey parthenotes. To create the parthenotes, the scientists treated 28 macaque ova with chemicals that prevent eggs from ejecting half their chromosomes—as they do when fertilized—and instead spur the eggs to begin dividing. Four of the 28 developed into blastocysts; the team was able to establish a stable stem cell line from the inner cell mass of one of them. From these stem cells, the researchers developed a considerable variety of cells, including dopamine-producing neurons and spontaneously beating cells resembling heart cells.

Other teams have teased primate ova into blastocysts parthenogenically, but this is the first report that such blastocysts can yield stem cells. The implication of this work, says Don Wolf of the Oregon Regional Primate Research Center in Beaverton, who has generated monkey parthenotes in his lab, is that "[embryonic stem] cells can be derived from human parthenotes."

Not everyone agrees. Developmental biologist Davor Solter of the Max Planck Institute for Immunobiology in Freiburg, Germany, says that even though the researchers have succeeded in generating normal-looking stem cells from monkey parthenotes, this reveals little about whether the same can be done in humans: "Every single mammal has its own quirks. If you want to figure out how to make [parthenotes] in humans, you have to make them in humans."

Ethically, however, the option is attractive. As in other primates, human parthenotes cannot develop to full-term babies. If researchers can find a reliable way to derive stem cells from human parthenotes, they could avoid therapeutic cloning, in which a potentially viable embryo is created as a source of stem cells and then destroyed. Bioethicist Glenn McGee of the University of Pennsylvania in Philadelphia predicts that this won't quell all objections, because people uneasy about stem cell research won't be very comfortable with "the idea of producing a creature whose status as a life-form is entirely ambiguous." Nonetheless, he observes that "the arguments against using embryos in research would seem to suggest that the parthenote is the ideal subject to replace the embryo."

Wolf says parthenogenesis would actually be simpler than therapeutic cloning for producing genetically compatible material for a patient—at least one with oocytes. "Of course, with this approach," he adds, "you could not produce your own stem cells unless you could also provide your own eggs. Sorry, guys." —CONSTANCE HOLDEN

CELL BIOLOGY

Molecular Motors Move In Mysterious Ways

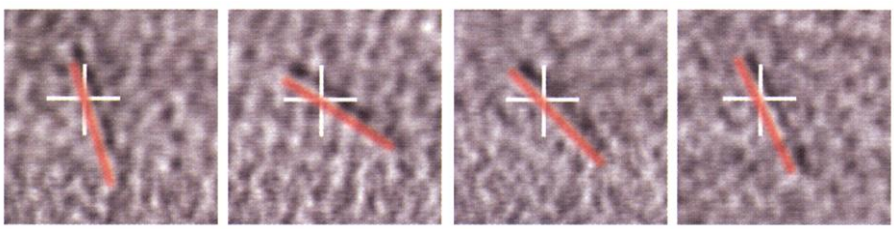
Behind a beating heart, fingers running fluidly across a piano, or a stomach cell shuffling nutrients to its neighbor are hundreds of motor proteins that make such motion possible. Yet even as biologists have been classifying these proteins and delineating their structures, they have long debated one critical question: How moveth the motors themselves?

Now, a trio of biologists delivers another in a series of jolts to this field. On page 844, Wei Hua and colleagues Johnson Chung and Jeff Gelles of Brandeis University in Waltham, Massachusetts, dispute the widely accepted mechanism of motion for kinesin, a well-studied member of the motor protein class. The three propose that kinesin, responsible for propelling cellular components and proteins along stiff fibers called microtubules, crawls like an inchworm rather than taking even, symmetrical steps. The theory is striking for, among other issues, its pronouncement that kinesin's two structurally identical "heads," clusters of amino acids that do most of the enzyme's work, perform vastly different tasks.

Already the work is prompting sharp words and reflection from those in the motor protein field. "Many of our beliefs and the models we've been proposing may turn out to be spectacularly wrong," says Steven Block, a biophysicist at Stanford University in Palo Alto, California, referring not only to the Hua paper but also to a parallel upheaval in the study of myosins, another major group of motor proteins.

Ironically, Gelles's group set out to prove the dominant theory of kinesin movement: that the enzyme's two heads alternately and symmetrically step over each other along the microtubule, a motion known as "symmetric hand-over-hand." To attempt to confirm hand-over-hand, the researchers made several adjustments that enabled them to follow individual kinesin molecules, which are normally just 70 nanometers long. First, they anchored kinesin to a glass plate but let the microtubule, a far larger structure to which kinesin is attached, move freely. Second, they slowed the motion of kinesin by restricting its access to energy-providing adenosine triphosphate (ATP). Finally, to amplify minuscule microtubule movements, the group made the connection between kinesin and the plate more rigid.

When Gelles and colleagues let the motor run, they did not witness the scene they'd expected. Symmetric hand-over-hand demands that each head make a 180° rotation for every 8-nanometer step it takes, says Wei Hua, now at Yale University. But the scientists, whose technology was capable of detecting rotation above 31°, found none at all. The group proposes a new "catch-up" model for kinesin movement: One head pushes forward 8 nanometers, stops, and drags the second along toward it.



No spinning around. A microtubule didn't rotate as expected under kinesin's power.

CREDIT: W. HUA ET AL.

Gelles's team was forced to make a secondary, decidedly unorthodox proposal to make its model fit with a basic rule of kinesin biology: that one ATP energy molecule is burned for every 8-nanometer step. In hand-over-hand, the heads presumably alternate burning, or hydrolyzing, ATP. Here, both heads forge the same 8-nanometer distance each time; therefore, only one head could be hydrolyzing the ATP molecule. The other head, the scientists predict, is chemically inactive while kinesin moves.

That two identical structures could wind up with such divergent jobs is a hotly disputed point of the paper. "It's hard to envision how you could relegate [different] functions to the two heads, given that they're produced by the same gene," says Sharyn Endow, a molecular geneticist at Duke University in Durham, North Carolina. Endow and others point to previous work they say shows that both heads hydrolyze ATP. The authors of the new study stand by their story but admit they're as befuddled as everyone else. "Maybe there's a reason for [the presence of] two heads that we don't know," says Hua.

Meanwhile, other researchers, such as