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

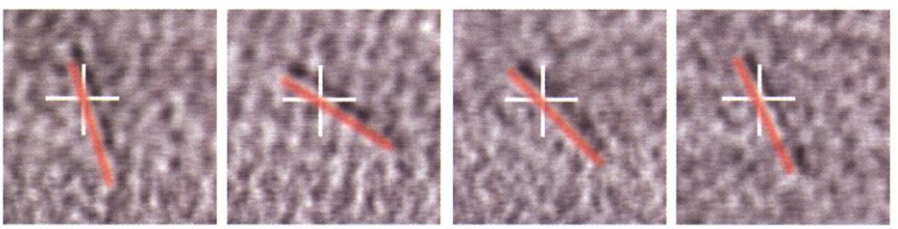
Behind a beating heart, fingers running fluidly across a piano, or a stomach cell shuffling nutrients to its neighbor are hundreds of motor proteins that make such motion possible. Yet even as biologists have been classifying these proteins and delineating their structures, they have long debated one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

Joe Howard, director of the Max Planck Institute of Molecular Cell Biology and Genetics in Dresden, Germany, favor yet a third model. In "asymmetric hand-over-hand," the kinesin heads step over each other but rotate little. The mystery might be solved if researchers can overcome a technical challenge universal to kinesin motion studies: the difficulty distinguishing between the two tiny heads. Scientists are experimenting with special dyes to do just that.

Myosin researchers can sympathize with their kinesin brethren. Recent work on these motors, which control muscles and transport various proteins, shows that two family members don't move as believed. Myosin VI, whose function remains a puzzle, apparently edges backward and takes far larger steps than its structure suggests is possible. And myosin V has been found to stay stuck to its filament during motion rather than lifting off periodically.

Motor molecules are "capable of some pretty surprising things that we might not have predicted," says Richard Cheney, a cell biologist at the University of North Carolina, Chapel Hill. And they're taking scientists along for the roller-coaster ride.

–JENNIFER COUZIN

SPANISH UNIVERSITIES

Reforms Spark More Jobs—and Protests

BARCELONA—Spain's government sees it as a cure for cronyism. The universities see it as an infringement on their autonomy. The bone of contention: a new law governing hiring practices that has triggered a mad rush to fill academic posts and has sparked a bitter row between the universities and the education ministry that funds them.

Last December, Spain's parliament passed government-sponsored legislation that subjects candidates for academic posts to peer review by national panels before they can apply for a job. In the weeks leading up to the law's passage, university rectors assailed the legislation, arguing, among other issues, that it would erode the autonomy of Spain's public universities, impeding their ability to hire top talent. At one point, the rectors appeared to be winning the public relations battle: On 1 December 2001, more than 100,000 people took to the streets to protest the law. But they lost the war when the bill became law a few weeks later.

Now the rectors are under fire from their own rank and file. In a 3-week period last fall, Spain's 48 public universities advertised some 4600 new positions, about twice the number posted during an entire year. Because the jobs were advertised before the new law took effect on 13 January, the slots will be filled under the old rules, in which five-member appointment boards select candidates by majority vote. But hiring so many people this year will have "hugely negative effects" by sharply limiting opportunities for young researchers in coming years, predicts inorganic chemist José Vicente of the University of Murcia.

The government's reforms are designed to reduce the universities' influence over the appointments board. Two of the five board members come from the university, so only one other member must be persuaded for the university to land its favored candidate. Thus the deciding vote often is "largely influenced by favoritism and mutual self-interest," contends astrophysicist Antonio Ferriz-Mas of the University of Vigo. An education ministry survey appears to offer some support for that claim: Professorial posts handed out under the old system went to internal or local candidates over 90% of the time.

According to the law, a new agency will first review the qualifications of aspiring applicants to sort the wheat from the chaff. Those who pass muster can present themselves to national boards of experts, who would recommend the best applicants to the university for final selection. The law will ensure that only capable individuals land professorial posts, says physicist Luis Rull-Fernández of the University of Sevilla.

However, the Spanish Council of Rectors (CRUE) claimed in a statement that the law erodes university autonomy, which it calls a "fundamental right" under Spain's constitution.

CREDIT: COORDINADORA DE PROFESORES CONTRA LA LEY DE ORDINACIÓN UNIVERSITARIA

Not reform-minded. A recent protest of the new university law sent thousands into the streets of Madrid.

ScienceScope

Time Limit German researchers are protesting a new law that would require aspiring academics to get a doctorate and a permanent university job within 12 to 15 years. Faculty members at the University of Bielefeld this week boycotted classes to protest the new rule, which lawmakers approved in December and German President Johannes Rau will sign soon.

Currently, would-be professors face some time limits on tenure-seeking and temporary research contracts, but a switch to a different institution restarts the clock. Under the new rules, researchers who don't find permanent posts within the qualification period—up to 15 years for medical scientists—would have to try to extend their contracts under general employment law or leave. Backers say the limits will bring new blood into academia and prevent institutions from exploiting temporary researchers.

But the Bielefeld protesters say the new deadlines are unrealistic given the scarcity of permanent posts. And they fear that thousands of contract scientists will lose their jobs under the law. University administrators are calling for a phase-in period that gives threatened researchers more time to adjust. German officials have yet to respond to the idea.

About-Face The U.S. military is planning to surrender a long-running HIV research program to civilian bosses, according to scientists. Caltech president David Baltimore, chair of the AIDS Vaccine Research Committee of the National Institutes of Health, said at a meeting this week that the Bush Administration has decided to transfer military HIV research—including a $40 million Army vaccine trial—to the Department of Health and Human Services. A Pentagon spokesperson declined comment, but an Army vaccine researcher attending the meeting confirmed the plan. Although similar past efforts were shelved, "this time it's going to stick," the researcher predicted. He said the decision was made 4 January at "a very high level."

AIDS is a significant problem in the U.S. military: HIV infects about 500 soldiers in active and reserve forces each year. But Secretary of the Army Thomas White ruled in a memo last year that studying HIV was a "nontraditional" military activity (*Science*, 20 July, p. 404). Congress still must approve the shift, which is expected to be included in the 2003 budget proposal the president will release on 4 February.

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