in a deterministic way."

It's too early to tell what effect the slow earthquakes might have on the risk of a blockbuster shakeup. Each slow event reduces strain locally but not in the locked zone, which is where the big ones break out. The slow earthquakes do have a menacing potential, Dragert warns. "Just as a taut violin string is more likely to snap during sudden rapid tightening," Dragert says, the locked zone—if close to critical threshold—might rupture when loaded with stress from a slow earthquake. This suggests that the likelihood of a major event may increase during slow-earthquake season.

But the CWU team points out that a large number of slow temblors may take place between each 500-year great quake. This makes it unlikely that any single slow earthquake is going to be a meaningful precursor. "I'm not convinced that they're a harbinger of disaster," Miller says. All agree, however, that slow earthquakes are likely to reveal more about how plate boundaries work.

Miller's team believes the regularity implies that slow earthquakes are a basic way that strain is relieved in this subduction zone. Continuous GPS observations are revealing similar, individual events at other subduction zones, such as Japan and Peru, Miller notes. (Other experts say they'd like to see more examples of periodicity from around the world before calling the mechanism fundamental.)

To learn more, Miller's team is exploring collaborations that would set down denser arrays of GPS stations with seismometers, strainmeters, and other instruments before a slow earthquake is scheduled to begin. And as continuous GPS networks become more common and more accurate in other parts of the world, the pace will be anything but slow.

–ERIK STOKSTAD

ENVIRONMENTAL FELLOWSHIPS

Will Congress Catch EPA's Falling STAR?

The U.S. Environmental Protection Agency (EPA) has pulled the plug on a popular, one-of-a-kind graduate fellowship program in the environmental sciences. This year, the program drew applications from about 1400 environmental science and engineering students, who now must scramble to find other support.

Agency officials say the move, announced recently on the agency's Web site (es.epa.gov/ncer), responds to a presidential proposal to end the $10-million-a-year program this fall. An EPA official familiar with the fellowship program, called Science to Achieve Results (STAR), says the agency is "being a good soldier" in assuming that Congress would concur with the president's 2003 budget request and zero out the program.

Supporting role. Granger Morgan says fellowships bolster EPA's "science-based" rules.

Awards for the 2002–03 academic year were due to be announced next month. But rather than making a commitment it might not be able to honor, the official said, EPA will instead send back reviewers' comments and suggest that students look for other sources of funding. The money saved in the 2002 budget will be doled out as needed to complete the multiyear awards for 211 current fellows.

Environmental groups are beginning to rally support for the program, pointing out that last year EPA director Christine Todd Whitman told Congress it "continues to successfully engage the best academic environmental scientists and engineers." The program is also important for the field, says David Blockstein, head of the National Council for Science and the Environment. "If the STAR fellowships end, there will be no dedicated funds for graduate fellowships in the environmental sciences." The demand greatly exceeds the supply, he adds: "Based on my experience as a reviewer, EPA could double the number of awards without diluting the quality."

Terminating the STAR graduate fellowships would undermine EPA's efforts to improve the scientific basis of its regulations, says Granger Morgan, head of the department of engineering and public policy at Carnegie Mellon University (CMU) in Pittsburgh, Pennsylvania, which has had several fellows. "It's been very important in funding top-flight students," he says, adding that the fellows also develop a relationship with EPA and a better understanding of its mission. "If you want science-based regulation, then you need to invest in the people to do it," Morgan says.

In addition to tuition support, the fellowships provide students with an annual stipend of $17,000 and research funding of $5000.

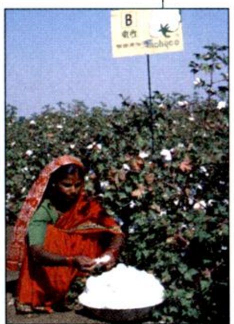
ScienceScope

Pondering Quality A new rule aimed at improving the quality of technical information released by the government could do both good and harm, experts concluded last week at a Washington, D.C., workshop. The data quality rule, issued by the White House Office of Management and Budget on 22 February, requires agencies to rigorously vet data in reports and regulations. It also allows citizens to challenge information that they think is inaccurate (*Science*, 13 July 2001, p. 189).

Legal experts at the National Academy of Sciences (NAS) workshop predicted that the rule's loosely defined call for "objective" review of "influential" information will trigger lawsuits. A business group has already cited the rule in challenging U.S. climate projections, but environmental activists could also use it to question industry data, suggested David Hawkins of the Natural Resources Defense Council.

Academic scientists, meanwhile, worry that they could become entangled by provisions that "third-party" data cited by the government be subject to review. That could be used to harass scientists, marking "the dark side of an otherwise positive development," says Washington, D.C., attorney Fred Anderson, a member of an NAS task force on data quality. Agency proposals for implementing the rule are due 1 April.

India OKs GM Cotton Indian agriculture reached a milestone this week as the government approved the first commercial release of genetically modified (GM) cotton. Farmers have been given a 3-year pass to plant three Bt cotton varieties developed by the Maharashtra Hybrid Seeds Co. (MAHYCO) in Mumbai. Under the new rules, farmers must plant at least 20% of any GM field with non-Bt varieties and surround them with five rows of non-Bt plants. MAHYCO must also report insect resistance and track annual GM seed sales. Monsanto, which imported the *Bt* gene, owns a minority stake in the company.



Some farmers like the promised higher yields, but environmentalists say the government's decision is premature. Pests are "bound to develop resistance," says Devinder Sharma, a food policy analyst with the Forum for Biotechnology and Food Security.

Contributors: Jocelyn Kaiser, Constance Holden, Pallava Bagla

CREDIT: (TOP TO BOTTOM) CARNEGIE MELLON UNIVERSITY; P. BAGLA

The program, begun in 1995, has supported some 784 fellows, two-thirds of them at the doctoral level. The fellowships are just one component of a $100-million-a-year STAR research effort, which will continue.

"It gave me the freedom to pick a research topic, as well as buy a computer and travel to conferences," says CMU environmental policy graduate student Felicia Wu, who expects to have completed her Ph.D. by the time her STAR fellowship ends in August. Wu, who hopes to work in the public policy arena, says that the 3-year fellowship allowed her to switch to a project on genetically modified corn after funding for a study of drinking-water quality ran out.

The STAR program is one of two EPA education programs targeted in the 2003 budget request, the other being $9 million for environmental activities with elementary and secondary school students (*Science*, 8 February, p. 954). The $19 million being spent on them would be shifted to the National Science Foundation. —JEFFREY MERVIS

NEUROSCIENCE

Neurons Turn a Blind Eye to Eye Movements

If our mind were to see what our retinas see, the world would seem herky-jerky. That's because our eyes continually dart from place to place, causing an image to jump about on our retinas. The brain smooths the scene by briefly blanking out visual perception when the eyes jump. A simple demonstration illustrates this: Look at one of your eyes in a mirror. Then look at your other eye. Then back to the first. You will not see your eyes move, even though a person watching over your shoulder would easily see the rapid eye movements known as saccades.

Neuroscientists have long debated the origin of this momentary blindness, known as saccadic suppression. Some argue that the brain does it solely based on information coming from the retina, while others think it uses additional, nonretinal signals coming from brain areas such as those that move the eyes. Now researchers have the first hard evidence for such an "extraretinal" mechanism. On page 2460, Klaus-Peter Hoffmann, Alexander Thiele, and their colleagues at Ruhr University in Bochum, Germany, report that they have identified visual neurons that distinguish between real movements of a scene and the shifts caused by saccades.

"This is the golden fleece that people have been looking for," says University of California (UC), Santa Cruz, neuroscientist Bruce Bridgeman, "neurons that respond differentially to a saccade." The results, he says, prove that extraretinal signals alert the neurons when a saccade occurs.

CREDIT: A. STONEBRAKER

Neuroscientists discovered decades ago that experimental subjects—whether people or monkeys—don't usually perceive images during a saccade. Work from many labs traced this inability to a so-called masking effect: Whereas the visual system receives crisp, clear signals before and after an eye movement, explains neuroscientist Robert Wurtz of the National Eye Institute (NEI) in Bethesda, Maryland, "what is received during the eye movement is blurred and of lower contrast." The blurred signal is swamped out by the stronger before and after views that come from the retina.

In 1968, Wurtz made recordings from monkeys' visual neurons that supported the masking model and cast doubt upon the role for extraretinal signals in saccadic suppression. He recorded from neurons in monkeys' primary visual cortex, one of the brain's first relay stations for visual information, under two conditions: while the animals were making saccades, or while they were holding their eyes still and the visual scene jerked in a way that mimicked a saccade. If the neurons received extraretinal cues during a saccade, they might respond differently in the two cases. But the neurons responded identically, suggesting that the only information they received came from the retina.

Since that time, researchers have characterized visual areas beyond the primary visual cortex. Hoffmann's team tested whether extraretinal signals of saccades may be reaching two of these higher visual areas, the middle temporal (MT) and middle superior temporal (MST) areas. They specialize in detecting motion and so have a strong need to suppress saccade-generated image motion.

Hoffmann's team recorded from MT and MST neurons in monkeys trained to focus on one spot in a scene projected onto a screen, then to shift their gaze to another spot. At other times the monkeys knew to keep their eyes steady while the scene shifted in a way that replicated its movement across the retina during the saccade. Some neurons responded identically in both cases. But others distinguished between the conditions, firing when the scene moved but not during a saccade. This was the smoking gun: Because the retinal signals were the same in both cases and the only difference was the eye movement, this suggested the neurons receive an extraretinal message that the eyes moved.

Other neurons responded in an even more remarkable way. Neurons in MT and MST normally register movement in a favored direction. But during saccades, some fired in response to motion in the opposite direction, effectively producing a false report of the direction in which the image moved. For example, during a saccade, a neuron that normally reacted to things moving to the right would instead respond to leftward motion. Hoffmann and his colleagues suggest that these "switching" neurons may cancel out signals from the neurons that respond normally to image movement induced by a saccade.

The experiment "pretty well nails" the idea that extraretinal signals help the brain suppress vision during saccades, says UC's Bridgeman. NEI's Wurtz agrees but notes that it does not negate the role of masking.

Invisible to you. Neurons in the MT and MST may suppress image movements encountered when the eyes jump.

Neuroscientist Richard Andersen of the California Institute of Technology in Pasadena suggests that MT and MST may have a special need to rely on extraretinal signals. These motion-sensitive areas show little activity when the scene is still, but when the eyes shift they are deluged with motion signals. The areas "need some way of canceling them," Andersen says, but may lack before and after activity strong enough for masking.

Some researchers question elements of the story, however. John Findlay, who studies eye movements at the University of Durham, United Kingdom, finds it "a little difficult" to accept that the neurons' signals would be similar enough in strength to cancel each other out. Others note that it is difficult to reproduce the way an image moves on the retina during a saccade; they worry that image discrepancies may account for some of the data. But none doubt the Hoffmann team's evidence that an extraretinal signal tells MT and MST neurons of a saccade. The next challenge will be to determine which brain area is sending that signal. Then yet another veil will be lifted from before vision researchers' eyes.

—MARCIA BARINAGA