would "at least partially reconstitute the photoreception events." It did: Adding CRY and exposing the system to light put an end to the gene repression by PER and TIM.

To see what protein CRY was acting on, the researchers then used antibodies to pull CRY from the cells. It emerged as part of a protein complex with TIM. That suggested, but did not prove, that CRY acts directly on TIM. Proof came when Kay teamed up with Charles Weitz at Harvard Medical School. Weitz's team performed a test called the two-hybrid assay, which uses yeast cells designed to turn blue when two foreign proteins—CRY and TIM in this case—bind to each other. The yeast test confirmed that CRY does directly bind TIM, and what's more, the pairing requires light. That shows that "cryptochrome actually is a photoreceptor that directly touches TIMELESS and sequesters it," pulling it out of action and thus resetting the fruit fly clock, says clock researcher Paul Hardin of the University of Houston in Texas.

As it turns out, things work differently in mice. Last fall, a team led by Aziz Sancar of the University of North Carolina, Chapel Hill, reported that mice missing one of their two *cry* genes have clocks with abnormal light responses. That suggested that CRY is a circadian photoreceptor. But the clocks of those mice also ran abnormally in the dark, convincing some researchers that CRY is a central component, rather than a light sensor, in the mouse clock. That idea got a boost in April, when Jan Hoeijmakers's team at Erasmus University in Rotterdam, Netherlands, showed that mice missing both *cry* genes have no clock at all (*Science,* 16 April, p. 421).

That report spurred Reppert to look at CRY's clock function in mice. The mouse clock, like the fly's, depends on a protein feedback loop, but in mice the PER proteins seem to enter the nucleus and shut off their genes without help from TIM. When Reppert's team tried to reconstitute the clock by putting active *per* genes into cultured fibroblast cells, however, the PER proteins did not move completely into the nucleus, nor did they completely shut off the genes. "Our cell culture assay was missing something," says Reppert.

When Kazuhiko Kume, a visiting scientist from the University of Tokyo, tried putting CRY into the cells, they were "blown away" by the result, Reppert recalls. CRY was the missing element: The gene inhibition that had been partial now was complete. In subsequent experiments, the team showed that CRY forms a protein complex with PER and helps it move into the nucleus, where CRY and PER turn off not only the *per* genes but the *cry* genes as well. The fact that CRY is "required to get the repression you need in the feedback loop" pegs it as a central clock component, says clock researcher Carla Green of the University of Virginia, Charlottesville.

CRY's shift in roles from a stimulator of gene expression in the fly to a repressor in mice is a fascinating evolutionary twist, says clock researcher Michael Young of The Rockefeller University in New York City. In the same evolutionary span, the protein seems to have lost its role as a photoreceptor as well, a function it maintains in organisms as diverse as plants and flies. It is too soon, Takahashi says, to say for certain that CRY is not, in addition to being part of the clockworks, also a photoreceptor for mammalian clocks, but "right now all the evidence suggests that it's not."

–MARCIA BARINAGA

KOREA

Faculty Protest Proposed Reform

SEOUL—Street protests by thousands of university professors have led the Korean government to modify an ambitious plan to enhance research and strengthen graduate education. Although officials say the changes are minor, some supporters of the government's plan worry that the modifications will severely undermine its goals.

The plan, announced this spring and called Brain Korea 21 (*Science*, 18 June, p. 1902), calls for spending $1.2 billion over 7 years on a handful of strategic fields, including biotechnology and materials science, as well as the traditional disciplines of biology, chemistry, and physics. The money would go to universities that have pledged to break down departmental barriers and reduce cronyism, as well as up-and-coming regional institutions. Some grants are targeted for newly formed groups from consortia of institutions that agree to cut the number of undergraduate students, expand their graduate programs, diversify admissions criteria, and establish a performance-based pay system for professors.

But last month in Pusan, 1000 university professors, mostly from the humanities and social sciences, carried signs and chanted slogans declaring that the reform—and the increased funding—bypasses their fields and could actually increase the concentration of resources at elite schools. On 8 July the protest was repeated in Seoul with double the number of disaffected faculty.

That pressure has led the government to open the door to proposals from outside the natural sciences and to scrap a plan to adopt a performance-based pay system. A typical professor at a national university with 2 decades of experience earns just under $3000 a month (private universities pay about 50% more), and some saw the proposed merit system simply as a way to reduce their pay. Officials at the Ministry of Education, which designed BK21, say that the natural sciences component is going ahead on schedule.

The concessions may have resulted from the weak position of a politically troubled government hit by several recent scandals. "The program is good for the universities. … But the simple story is that the government is politically unable to do it," says Chung Sung Chul, director of the Science and Technology Policy Institute in Seoul. An editorial in the English-language *Korea Herald* says that eliminating the proposed merit-pay system invalidates the plan, which takes aim at "the poor research records of professors and a closed recruitment system." Without those changes, the newspaper says, "the BK21 is simply a waste of tax money."

Research rumble. Korean professors demonstrate in Seoul against government plans for higher education.

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Most scientists still back the plan, however, because it promises strong support for high-quality research. Last week Lim Jeong Bin, a biology professor at Seoul National University, was preparing his group to meet a 20 July deadline for BK21 applications. He remains optimistic that the plan will not unravel. "I think the protests will subside," he says, and the government will move ahead.

–MICHAEL BAKER

Michael Baker writes from Seoul.