Harrison Case: No Calm After Storm

After mathematician Jenny Harrison gained tenure at Berkeley, settling a sex discrimination suit, her critics began waging a public campaign against her and the university

Four months ago, Jenny Harrison was appointed a full professor in the math department at the University of California, Berkeley, ending a bruising 7-year sex-discrimination battle and settling the lawsuit she filed after being denied tenure in 1986 (*Science*, 16 July, p. 286). But if Harrison and the university administration hoped her appointment —which came after a recommendation by an independent review panel—would resolve the controversy swirling around her career at Berkeley, they have been disappointed. In fact, the decision to grant Harrison tenure has triggered a backlash in the department against her and the university administration.

Soon after Berkeley chancellor Chang-Lin Tien appointed Harrison on 1 July, a public campaign against her was initiated by the only other tenured woman in the math department, Marina Ratner. Ratner and five other members of the department wrote letters to newspapers and magazines, sent material critical of Harrison around the country, and wrote public electronic mail messages criticizing her, the administration, and the settlement. Berkeley mathematician Alexandre Chorin accused Harrison of winning "her appointment by a disgraceful campaign based on lies, distortion, and slander." His colleague Robion Kirby added: "The Harrison camp trashed the math department from the mail room bulletin board to the *Congressional Record* over several years."

The critics' harsh words were not reserved for Harrison. Berkeley math professor David Gale called the process by which Harrison was reinstated "a monumental disgrace." His colleague Murray Protter said the procedure had "a facade of fairness" but was "stacked in favor of her appointment." Even Berkeley mathematicians who are not vocal critics of Harrison have qualms about the fact that the process was secret and that details of how the decison was made—including names of the members of the review panel—have not been disclosed.

The conflict simmered through the summer and into the fall. In August, administration officials held a meeting with the most vocal critics in an attempt to respond to their attacks. This effort did not have the desired effect: Not long afterward, nine mathematicians from the department wrote an open letter to the head of the academic senate criticizing Harrison and the settlement. And recently the controversy has begun to spread beyond the university, as two mathematicians from other institutions weighed in with strong opinions—pro and con. Yet the number of vocal partisans on both sides is small, and during the controversy the majority of the math department seemed to want nothing more than to "get on with the process of doing math," as one member of the department put it.

Storm center. Jenny Harrison.

Is this a tempest in an academic teapot—a small group of disgruntled mathematicians who can't accept fair settlement of a gender discrimination suit? Or has the university, in a hurry to avoid financial damages and bad publicity in an era of political correctness, betrayed its own principles? Beyond those questions, settlement of the Harrison case and the reaction to it raise the broader question of how allegations of sex discrimination should be handled at elite research universities.

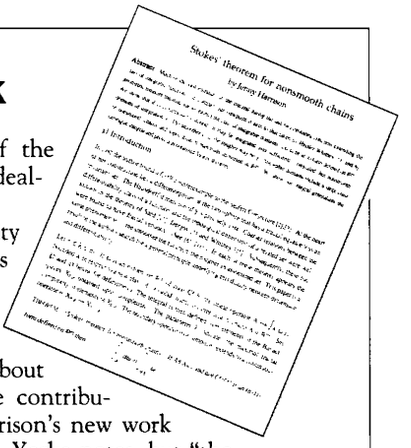
Although the charge of gender discrimination was the basis for Harrison's suit, the settlement was not a verdict on whether Harrison suffered gender discrimination when she was denied tenure in 1986. *Science* has learned that the settlement was based on the recommendation of a seven-member panel of academics, five of them mathematicians, including two from Berkeley. The panel reviewed Harrison's research and teaching record and unanimously recommended that she be hired as a full professor with tenure. The committee was instructed not to address the issue of sex discrimination in the tenure decision; instead, they were asked to focus on whether Harrison is currently qualified for tenure at Berkeley.

To decide whether Harrison deserved tenure, the committee first compared her early work to work done by the nine men and one woman promoted to tenure in math at Berkeley since 1977, when Harrison came to the department. That early work included her first two notable results, which had been completed by the time of the departmental tenure review in 1986 (although the committee also included in its consideration several papers related to the second result that were finished after the departmental review). The committee concluded that Harrison's research put her in the lower middle of the comparison group: above 3, equal to 2, and below 5. Her teaching, they said, was above average, her supervision of graduate students "unusually good," and her service to the university community comparable to that of the others. Based on this combination, the committee recommended that she be given tenure.

Next, the committee tackled the question of whether Harrison should be appointed associate or full professor. It compared her recent work to the work done by the 10 in the comparison group to move from associate to full professor (all 10 have earned that promotion). Harrison's recent work included her third significant result. Since that result is a central part of the recent controversy, *Science* assigned our mathematics correspondent to conduct a review of it (see box on next page).

The independent review committee concluded that the quality of Harrison's latest work, including her third significant result, was "in many cases comparable and in some cases higher" than that done by the 10 others

Reviewing Harrison's Latest Work


Stokes' theorem for nonsmooth chains
by Jenny Harrison

In a paper to appear this month as a research announcement in the Bulletin of the American Mathematical Society, *Jenny Harrison takes a theory known as Stokes' theorem and extends it to new domains. Because Harrison's recent work played a key part in the settlement of her sex discrimination suit against the University of California,* Science *asked its mathematics correspondent, Barry Cipra, to obtain expert judgments of Harrison's recent work. His report follows.*

Stokes' theorem is a generalization of Newton and Leibniz's fundamental theorem of calculus. Loosely speaking, it equates integration on a geometric region such as a surface with integration on the region's boundary. Classically, Stokes' theorem requires that these boundaries be nice and smooth, but that's not always the case. That's where Harrison steps in.

Following work by the late Hassler Whitney at the Institute for Advanced Study in Princeton, Harrison developed a theory of integration for objects called chains that makes sense of Stokes' theorem in cases where the objects being integrated over are so wild that ordinary integration breaks down. Part of her purpose, Harrison told *Science*, is to provide techniques that will allow scientists to do rigorous mathematical work with some of the fractal models now in vogue.

The majority of the approximately 20 mathematicians contacted by *Science* declined to comment on Harrison's recent work, citing unfamiliarity or a desire not to get involved in the controversy at Berkeley. Four, however, were willing to speak, all specialists in dynamical systems, Harrison's subfield.

"What she's really doing is calculus on fractals," says Robert Devaney of Boston University. Devaney is unreservedly impressed with Harrison's recent work, calling it "a beautiful synthesis of classical ideas" that establishes "a deep relationship between the dimension of the space you're working in—the fractal dimension—and the smoothness of the map [i.e., function] that you're dealing with."

James Yorke of the University of Maryland, one of the founders of chaos theory, agrees. Because of its central role in the calculus of several variables, "anything new you can say about Stokes' theorem is a valuable contribution," he says. Not all of Harrison's new work involves difficult mathematics, Yorke notes, but "the parts that aren't that deep are quite pretty. And there are other parts that are quite deep."

Dennis Sullivan at the City University of New York, a leading expert in complex dynamics, was positive, though less effusive than Yorke or Devaney. "It's always important in math to extend the existing structures to their largest and most natural domain of definition," he says. A number of problems in mathematics are related to lack of smoothness, Sullivan says, and Harrison's geometric approach is one way of attacking those problems. "I can't really say [of Harrison's work] 'This is great' or 'This is not great,'" he says. "It's solid work, and it's a step that should be taken. It's just normal, solid mathematics. I would be happy to do it myself."

Morton Brown of the University of Michigan goes further: "I wish I had done it," he says. While noting that he hasn't closely read her most recent papers, Brown says he knows the problem she's working on and thinks it's significant. In Brown's opinion, Harrison's research will be the basis for future work on integration of nonsmooth curves. "I think it will make a mark in mathematics."

–Barry Cipra

in being promoted to full professor. Therefore they recommended that she be appointed full professor. The report's conclusion, provided to *Science* by Dan Siegel, Harrison's lawyer, states: "Our overall impression of Harrison is that she is an outstanding, creative mathematician whose research is of the caliber expected for tenure at Berkeley."

Chancellor Tien took the panel's advice and appointed Harrison a full professor. Criticism began immediately, starting with Ratner, a member of the National Academy of Sciences and a highly regarded researcher in the subdiscipline called ergodic theory. On 11 July, Ratner e-mailed the mathematics and statistics faculty that the settlement "certainly does not make [Harrison] qualified for the job, which she got through years of lying and a massive propaganda campaign which went unanswered." Ratner also wrote critical letters that were published in the *San Francisco Examiner and Chronicle* and in the newsletter of the Association for Women in Mathematics (AWM).

When Ratner was asked by *Science* what the "lies" were that she had mentioned in her e-mail, she said Harrison's claims of gender discrimination were false; in fact, Ratner says, the department made an "exceptional effort to save Harrison's tenure." Ratner pointed out that Berkeley's Privilege and Tenure Committee, a faculty committee charged with monitoring grievances of faculty and allegations of misconduct at the university, spent 80 hours questioning 25 witnesses to review Harrison's claims. (The committee was not responsible for deciding whether Harrison should have received tenure; they were asked simply to decide whether the process was flawed.) In its September 1989 report, the committee concluded there was "no demonstrable evidence to the charge that gender discrimination existed in the department." Ratner also argues that the department has made "enormous" efforts to recruit women, including three offers to women in the past 8 years, two of whom accepted. (One has resigned; another is an assistant professor.)

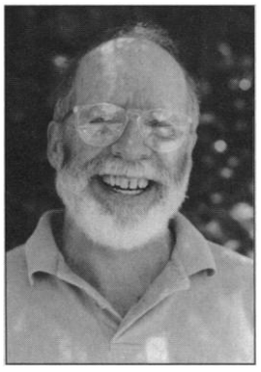
Long-time Harrison opponent Rob Kirby calls Harrison's charges of sexism in the math department "like being accused of child molestation when you're completely innocent"—because both kinds of charges are so difficult to disprove. He says "people went out of their way" to treat Harrison "as nicely as one can." She was given a rare 3-year leave, he said, to spend time at Oxford University. More generally, he says, the Berkeley math department has elected several pro-affirmative action chairmen. "Is it not curious," he says, "that the department, often by huge majorities, should elect pro-women chairs, and yet be called prejudiced?"

Although the settlement offered no conclusion on the issue of gender discrimination, university provost Carol Christ told *Science* that "the [math] department was judged not guilty of sex discrimination in 1986 [by the Privilege and Tenure Committee], and that's what the administration accepts."

For her part, Harrison argues that the process leading to the Privilege and Tenure Committee conclusion was flawed. For example, she says, she couldn't question witnesses about confidential matters. Nor could she gain access to confidential files she needed to make her case. That material came out, she says, only during pre-trial discovery in her suit, a process that included 110 hours of depositions, questioning of 17 witnesses under oath, and the release to her of more than 1000 pages of confidential documents. As a result, Harrison claims, if her suit had gone to a jury, she was prepared to document specific

instances of gender discrimination that affected her career in the math department.

Harrison adds, however, that "I don't think the majority of people in the department are biased." Furthermore, she says, she doesn't think it's "appropriate or constructive" to argue over charges of discrimination now. "I just don't want to rehash it." Now that she's a tenured member of the department, she says, "I just want to prove some theorems, teach some students, and get along with my colleagues."



Robion Kirby

Although Harrison says she doesn't want to rehash the issue of gender discrimination, some support for her claims comes from two former chairmen of the Berkeley math department who are advocates of hers. Morris Hirsch says Harrison was denied tenure out of a "combination of habit and prejudice." John Kelley, who was chair when Harrison was hired as an assistant professor in 1978, says there is "antiwoman prejudice in the Berkeley department, and, in fact, in all math departments." In addition, two faculty member assistants to the chancellor, who were responsible for reviewing women's issues, independently concluded Harrison was treated unfairly in her 1986 tenure review. One specifically cited sex discrimination in recommending that the department's decision to deny Harrison tenure be overturned.

If Harrison's critics were upset with her for claiming discrimination, they were also angry at the university for what they saw as a betrayal of its collegial principles in granting Harrison tenure. As mathematician David Gale put it in an e-mail to the math department: "Action at the department level is the primary and most important part of the whole appointment process ....Only in this one case has the administration seen fit, for reasons I suspect we will never know, to violate its own rules by circumventing the entire appointment procedure."

Provost Christ acknowledges that university rules were not followed in the settlement, since those rules call for all personnel decisions to originate in the department. "The department didn't have the conventional role," Christ says, "but this was not a usual case and we can't pretend the university entered into it with a blank slate." And, as *Science* has learned, the department was not excluded altogether. In 1991, when the possibility of a settlement was being considered, the then-chairman of the math department, Alberto Grunbaum, consulted about a dozen members of the department concerning the possibility of settling. The dozen were "primarily Harrison critics," says Grunbaum, and "the majority" felt settling was "the less undesirable path."

Furthermore, Christ says, the procedure was not unprecedented. She cites two previous cases at Berkeley in which sex discrimination suits were settled via a review procedure bypassing the department: Eleanor Swift in Berkeley's Boalt law school and Margarita Lovel in the art history department were denied tenure in departmental votes but reinstated after extradepartmental reviews recommended tenure. "In each case," says Christ, "the department accepted [the outcome], and they are well functioning members of the department."

In Harrison's case, however, a contingent of the math department has not accepted the outcome. One reason is their suspicion that the university predetermined the outcome of the external review that recommended Harrison's being given tenure. In an open letter to the math department in July, Berkeley mathematician Murray Protter "speculated" that out of fear of bad publicity, which would adversely affect state funding and private donors, "the university lawyers decided that settling the case was the only preferred route. To settle the case meant giving Harrison a position on the faculty. The problem arose as to how this could be done with an appearance of fairness, but in a way which would not jeopardize the end result."

One reason for fear of bad publicity, say some of the critics, was that while pursuing her lawsuit, Harrison contracted throat cancer. Christ concedes that a factor in the university's decision to settle was that Harrison's cancer "made her a sympathetic plaintiff." But that was not the main reason for settling, Christ insists. The "overwhelming concern" she says, was to avoid "the precedence of having tenure decision by jury rather than [peer review]." In addition, she says, a trial would have caused "extreme divisiveness in the math department."

Carol Christ

Christ denies that the university's willingness to settle the suit before it went to a jury meant that the outcome of the settlement was predetermined in Harrison's favor. In fact, she calls that charge "not very credible," because even if the administration had decided to stack the deck in Harrison's favor, they could not have done so, since a wide range of people, not all of them part of the administration, were involved in selecting the review panel.

Science has learned that the selection process began with Harrison and Grunbaum agreeing on a list of 42 people, the majority mathematicians. In an attempt to rule out biased reviewers, a university official trusted by both sides interviewed candidates by phone. Harrison had no say in picking the final seven on the review committee; the seven were chosen by Christ in consultation with a 10-member academic senate committee known as the Budget committee.

Therefore, in order for the review panel to be biased in Harrison's favor, says Christ, "the chairman [of the math department] would have had to stack the court. I would have had to stack the court. The Budget committee would have had to stack the court." In addition, argues Christ, the university had little motivation to pick a pro-Harrison panel, since as part of the settlement, Harrison waived her right to sue if the outcome went against her. As for the committee, a senior university administration official says it included "experts in her field, people generally knowledgeable about mathematics, and representatives of the mathematics department." Eight letters of evaluation were received by the committee from a list of people agreed to by Harrison and Grunbaum. During the review the committee asked for and received two more letters.

The university would not divulge the names of the members of the committee or the outside letter-writers. Nor would the university divulge details of the settlement procedure. Asking for more information, a group of Harrison's opponents wrote university vice chancellor John Heilbron. In late August, Heilbron met with six Harrison critics. Heilbron also invited Grunbaum and Jack Wagoner, current chair of the math department. At the meeting, Heilbron discussed some details of the settlement but refused to name the committee or release their report or the letters of recommendation the committee solicited from other mathematicians. Heilbron also warned Harrison's critics that they were "perilously close to violating the faculty code of conduct" because their public criticism of Harrison could be construed as uncollegial.

The next protest, an open letter to Bruce Bolt, chairman of the faculty Senate, sent in early September by nine members of the math department (Kirby, Gale, and seven others), focused on the "substantial damage" done to the math department and to "the cause of due process at Berkeley." Harrison's public criticisms of the math department for sexism and her attacks on the Privilege and Tenure proceeding (including describing it to *The Los Angeles Times* as a "kangaroo court") left "the impression in the public mind," the signers wrote, "that the Berkeley

math department is sexist and the machinery of due process at Berkeley is rigged."

Recently, the controversy has begun to grow into a discussion of the tactics female mathematicians who feel they have been discriminated against should use. Lenore Blum of the Mathematical Sciences Research Institute, an independent research center associated with Berkeley, who is a founder of AWM, wrote a 24-page account of the Harrison case called "Breaking the Silence." Blum's account is bitterly critical of Harrison, Harrison's closest supporters, and their tactics. She writes that those skeptical of Harrison's claims "became targets of charges of sexism, and this created an atmosphere of fear and intimidation...in these times, accusations of sexual discrimination...are loaded and deadly serious, as Harrison supporters well knew."

In a letter to Ratner, written in response to her letter in the *Examiner*, and submitted to the AWM newsletter, mathematician Mel Rothenberg of the University of Chicago writes: "Much of the anger in your letter seems to flow from the fact that Harrison and her supporters waged a vigorous public and legal campaign to reverse a departmental decision. There are mathematicians who feel that such activity is improper and somehow unprofessional. I don't agree. Such campaigns, while sometimes unpleasant and disruptive of academic tranquillity, are a legitimate way of coming to grips with serious social issues. To characterize them generically as forms of intimidation or harassment is to deny the legitimacy of any forms of social protest."

Yet while the opinions were sharp, the combatants were few, according to Berkeley provost Christ: "The number of people voicing disagreement with the decision is quite small." In fact, the majority of the math department seems eager to move on. More than 20 department members sent Harrison messages welcoming her back. Among those who stayed out of the fray, opinions vary widely, as *Science*'s interviews show. Some resent the university for keeping the process secret, others resent Harrison for dragging the department through a grueling battle and for not "going where they love her," as one mathematician put it. Others said they "admire her courage" and are "elated that she's back." Most, however, simply want to put the heat of the controversy behind them and get back to their theorems.

–Paul Selvin

Paul Selvin is a postdoc in chemistry at UC Berkeley.

NUCLEAR POWER

Superphénix Set to Rise Again

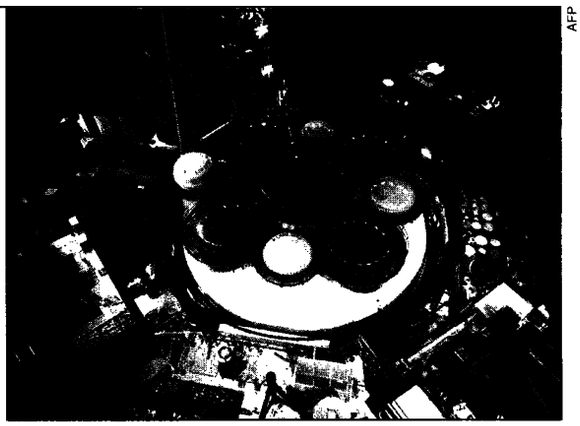
PARIS—Superphénix, France's seemingly jinxed fast breeder reactor, which has not produced a single kilowatt of energy in more than 3 years, looks set to rise up next year like the mythical bird it is named after. The $5 billion reactor, the largest fast breeder in the world, has just been given the seal of approval by a public commission ordered by the government to look at the pros and cons of restarting.

It still has hoops to jump through: a safety check and approval from the ministries of industries and environment. But the consortium of French, Italian, and German power utilities that run the plant are confident they can get it running by next summer. The Superphénix that rises out of the ashes will, however, be a different species of bird from the one planned 20 years ago. The consortium plans to turn the reactor into a "debreeder," one that will incinerate more plutonium than it produces and so eat into Europe's plutonium stockpile.

In 1973, when work on Superphénix began, planners foresaw continued growth of nuclear power and a consequent shortage of uranium. Fast breeders were the solution: A core of uranium and plutonium is surrounded by a blanket of nonfissile uranium-238, "waste" from conventional reactors. Fast neutrons emitted from the core as it burns transform the uranium-238 into fissile plutonium-239, which can be used as reactor fuel. As the reactor generates power, it "breeds" more fuel than it consumes.

Superphénix, the first commercial-scale fast breeder, was built at Creys-Malville on the Rhône River near Lyons and was fired up in September 1985. Two years later it was temporarily shut down after it sprung leaks in its liquid sodium cooling system. Other incidents followed, culminating in the collapse of a turbine hall roof during heavy snow in December 1990.

By May last year, repairs and alterations had been carried out and the reactor was ready to fire up again. But Pierre Bérégovoy, then France's socialist prime minister, put plans for the plant on hold. Europe's nuclear politics had changed: Fewer conventional reactors were being built and uranium was in plentiful supply; environmental groups warned of the dangers of transporting and reprocessing plutonium, which is not only highly poisonous but is the stuff that bombs are made of. Bérégovoy established a commission to investigate the benefits of restarting the plant and the proposal to use Superphénix to incinerate plutonium.



AFP

Debreeder. Superphénix's core.

Getting a fast breeder reactor to debreed is not that difficult. "In fact," says Jeffrey Lewins of Cambridge University's engineering laboratory, "you have to make an effort to make it breed; it's simpler to make it consume." The rate of breeding is governed by the relative quantities of uranium and plutonium in the core and the amount of uranium-238 in the blanket. If the blanket is completely replaced by a steel container, the core will burn more plutonium than it creates. Calculations by Superphénix staff and the Atomic Energy Commission indicate that a "plutonivorous" fast breeder could incinerate 15 to 25 kilograms of plutonium while producing 1 billion kilowatt-hours of electricity—scarcely enough to make a dent in the tonnes of plutonium produced by Electricité de France's reactors each year.

The technological fix of burning up waste in a nuclear furnace has not won over environmentalists, who have condemned the commission's recommendation to give Superphénix the go-ahead. Former environment minister Ségolène Royal emphasized the continued risks involved in transporting and reprocessing plutonium. Greenpeace denounced the secretive nature of the investigation, calling it "a parody of democracy."

The Superphénix consortium is anxious to get the reactor back on line. The annual cost of upkeep and repair of the idle plant and salaries for its 700 staff may reach $140 million this year, 20% more than if the plant was running normally. If restarted, the existing core and a second one ready on the shelf will generate electricity worth $1.3 billion.

By French law, a nuclear plant that has been shut for more than 2 years must gain safety approval again as if it were new. But its owners are confident that a new-look Superphénix will soon take flight. The project's assistant director, Alain Roux, predicts: "We'll be ready to raise the bars in June next year."

–Alexander Dorozynski

Alexander Dorozynski is a science writer living in Paris.