Science in Court: A Culture Clash

Vituperative arguments over DNA fingerprinting epitomize the difficulties of settling scientific disagreements in a highly charged legal environment

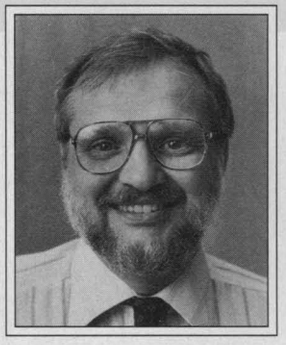
Peter Neufeld and Barry Scheck say they were just doing their jobs when earlier this year they accused several prominent scientists of concealing conflicts of interest and financial biases and of giving false and misleading testimony. And they weren't finished. Next they charged that the researchers—in league with federal law enforcement officials—meddled in the peer-review process at leading scientific journals, and they implied that the journals' editors are in the coat pockets of the Federal Bureau of Investigation (FBI).

Who are these accusers—federal investigators rooting out fraud and scientific misconduct? No, Neufeld and Scheck are civil liberties lawyers who specialize in defending people charged with crimes on the basis, at least in part, of evidence derived from the new technique of DNA fingerprinting. The targets of their attack were scientists who had appeared as expert witnesses for the prosecution in a landmark trial, *U.S.* v. *Yee*, in which DNA evidence played a crucial role in securing the conviction of three defendants on federal weapons charges. And, dispensing with professional courtesy, the lawyers also turned their guns on the prosecutor in the case, James Wooley, accusing him of unethical behavior. Wooley and his boss have shot back, calling the charges "outrageous" and "slanderous." And Wooley's allies in the FBI have also replied in kind, accusing some researchers who side with Neufeld and Scheck of being hired guns, willing to sell themselves for a few bucks—or a few thousand.

Welcome to the world of DNA fingerprinting, where for the past several years some of the nation's leading geneticists and molecular biologists have taken the stand to attack or defend this powerful new forensic tool, only to find themselves locked in a legal tussle in which they don't understand the rules and are unprepared for the vehemence with which lawyers go after them. Scientists who enter the courtroom out of professional duty find their motives questioned and their integrity impugned, and they quickly find that the best scientific credentials count for little on the stand. While the scientists are there to debate the best methodologies, the proper interpretation of data, and the fine points of quality control, the lawyers are out to win—and they use any tool at their disposal. Scientists find unfavorable peer-review comments subpoenaed. Scientific mistakes and inconsistent statements from different papers are dredged up and used against them (see box, p. 733). There is no room for subtlety or nuance and certainly not human error or scientific misjudgment. Instead, the normal processes of scientific debate, of error and correction, are used to pillory witnesses on the stand. Observes Peter Huber, a senior fellow at the Manhattan Institute who recently wrote a book on expert witnesses: "Good scientists hate the courtroom—the presumption is that they are lying and cheating. It is total culture shock."

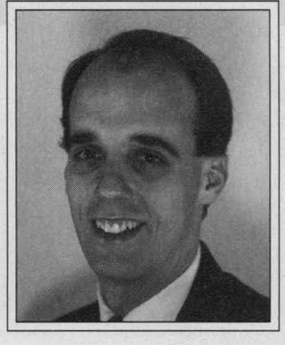
"I never expected [being an expert witness] to be so adversarial." It was "harrowing."

–Daniel Hartl



"I treated [Hartl] like any other prosecutor in the world would have. I cross-examined him hard, but he deserved it."

–James Wooley



This culture clash is not confined to DNA fingerprinting. Indeed, legendary battles have occurred between lawyers and expert witnesses over data on asbestos and toxic wastes, for example. But what makes DNA fingerprinting arguments so vituperative are the stakes. The scientists are battling over whether DNA evidence is reliable enough to be used to convict people or set them free, and defendants' lives can literally hang in the balance. And DNA evidence can be so persuasive to juries that the lawyers have every incentive to get it disqualified or admitted. They have mounted nationwide campaigns and set up elaborate networks to keep tabs on the scientists who testify for the other side. A few of the lawyers, like Neufeld and Scheck and their counterpart, Rockne Harmon, a prosecutor in California, have become so steeped in the science that they have no qualms about taking on leading scientists on their own turf.

Nowhere is the clash between these two worlds more evident than in the experiences of Daniel Hartl of Washington University and Thomas Caskey of Baylor College of Medicine, two leading geneticists who testified on opposite sides in the *Yee* case. Hartl, who testified for the defense, was a neophyte in the rough and tumble legal world; Caskey, a prosecution witness, was a seasoned hand who had testified a half-dozen times. Both were left bruised and bleeding from their collision with the legal system. And both learned the hard way that when science enters the courtroom, the normal rules of scientific discourse go out the window.

Showdown in Ohio

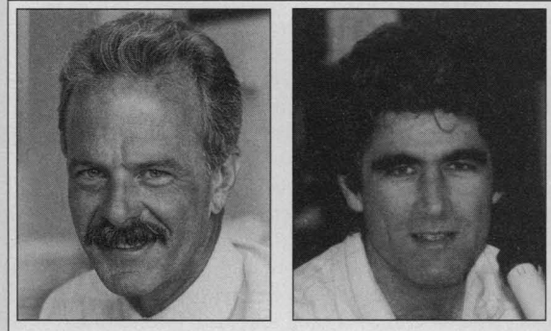
In the *Yee* case, three Hell's Angels, Stephen Wayne Yee, Mark Verdi, and John Ray Bonds, were accused of murdering a record store clerk, whom they allegedly mistook for a rival gang member, while he was making a night deposit at a bank in Sandusky, Ohio. A critical piece of evidence—though there were others—was a genetic match between the blood of one of the defendants, Bonds, and blood found in the victim's van. The prosecution contended that Bonds injured himself during the assault and bled in the victim's van as he drove it away. Defense attorneys sought to keep the evidence out of court on the grounds that DNA fingerprinting is not yet reliable or generally accepted, calling in Neufeld and Scheck to argue the case before a federal magistrate in Ohio.

DNA evidence had been challenged plenty of times before, but this pretrial hearing, which stretched over the summer of 1990, was billed as the ultimate showdown, and the *dramatis personae* included some of the lead-

Prosecutor v. Scientist: A Cat-and-Mouse Relationship

The first meeting between population geneticist Laurence Mueller of the University of California, Irvine, and Alameda County prosecutor Rockne Harmon set the tone for what has become one of the longest and nastiest battles between scientists and lawyers in the remorseless war over DNA fingerprinting. Mueller was testifying for the defense in *People* v. *Barney* in the spring of 1989 when Harmon informed him that a criminal record check had turned up the fact that Mueller did not have a California driver's license. "The Oakland jail is not a nice place to spend the night," Harmon intoned. Harmon says he was joking; Mueller says it was the first of many attempts to intimidate him.

Harmon is arguably the most aggressive prosecutor defending DNA fingerprinting against court challenges. He devotes about 70% of his time to such cases and is the linchpin of an unofficial network of prosecutors and the FBI. He maintains extensive files on scientists who testify for the defense and exchanges tips with other prosecutors on how to trip them up on the stand. His fattest file is on Mueller, one of the technology's most persistent critics.



Dogged pursuit. Harmon *(left)* and Mueller.

Ever since that first encounter, Harmon has dogged Mueller's every move, scrutinizing his testimony in each case and writing him letters when he thinks his science is wrong or his ethics questionable. Indeed, Mueller seems to have almost become an obsession for Harmon.

Harmon dismisses Mueller as a hired gun peddling half-baked scientific ideas and doubling his income in the process—Mueller has testified more than 40 times in the past 3 years and made more than $60,000 last year consulting or testifying in DNA cases. As Harmon tells it, Mueller breezes into court with an ever-changing repertoire of analytic approaches and numbers to refute the FBI's statistical methods for determining the odds that a match between two DNA samples could occur by pure chance—and he abandons these analyses once the prosecution reveals them as flawed. To add insult to injury, contends Harmon, Mueller blithely changes his tune without notifying lawyers from earlier cases that his past testimony was flawed.

"Nonsense. None of the salient features of my testimony have changed at all," responds an obviously exasperated Mueller, who describes Harmon as an extremist on a vendetta who will stop at nothing to discredit him, both in court and in the scientific community. Mueller says he is not surprised by the vehemence of the attack, chalking it up not to his expertise or stature, which he says pales in comparison to that of Daniel Hartl of Washington University or Richard Lewontin of Harvard—two population geneticists who testified in the *Yee* case (see main story)—but his persistence. "Lewontin and Hartl are a thorn in their side, but they were only willing to testify once [or twice]. That makes me a real nuisance."

Mueller concedes he has tried different statistical techniques in his analyses. And one time he did find an error—himself, he points out—when he mistakenly thought he could do without a correction factor. When he redid the analysis, the numbers did change—but the bottom line was still the same. "It happens in research all the time. People do work, try different methodologies, and hope their conclusions will be robust enough to withstand different statistical methods. To Rock, the fact that the numbers change is a big deal."

As for the hired gun accusation, Mueller has heard it so often that it runs off his back. "That is part of the legal game. They make it seem that because we are compensated for our time, we are willing to say things we don't believe. I disagree strongly with other people who testify, but I don't think anyone has said anything they don't believe."

Harmon, though, is not persuaded and has taken it upon himself to inform the legal world—and Mueller's peers and bosses—about what Harmon sees as his questionable science. After some of his court appearances, Mueller has received a letter from Harmon, criticizing the "shifting" nature of his science and chiding him for not notifying the court about his errors, especially since his mistakes "could conceivably result in a vicious, violent criminal being erroneously freed to continue to prey on society." Once, Harmon even sent a copy to Mueller's department chair and the university chancellor. And each time Mueller appears in court, Harmon sends the ever-growing file of transcripts and unanswered letters to the new prosecutor.

Harmon maintains that the letters are simply intended to set the record straight, to hold Mueller accountable, and to ensure that criminals are not set free on the basis of "knuckle-headed ideas." Says Harmon: "I am assertive and aggressive and I am not ashamed of anything I have done." But as Mueller sees it, Harmon is trying to make testifying so unpleasant that he will abandon it, which he has no intention of doing.

Harmon's letters go unanswered. But his friend, Bruce Budowle of the FBI's DNA fingerprinting lab, thinks that Harmon never really expects a reply. "He is creating a document that provides questions for other prosecutors to use in court. His letters end up in court, in the prosecutor's hands. In Harmon's letters are all the proper questions to ask on the stand. If Mueller does not want to answer the questions to Harmon, I guarantee he will have to answer them to someone on the stand."

Nor does Harmon confine himself to the courtroom. When Mueller made the mistake of listing on his December 1990 curriculum vitae two papers that were submitted but not accepted, the editors at *Science* and *Genetics* both received one of Harmon's missives, disparaging the quality of Mueller's work and urging vigorous peer review. As always, Harmon also sent a copy of the letters to Mueller. "I am very courteous," explains Harmon. Courtesy is not the issue, snaps Mueller. "The point was to let me know he was doing it, and that the scientific community would hear all this garbage about me every time I send in a paper."

Harmon and Mueller's cat and mouse game reached new heights when Harmon and his network of prosecutors embarked on an effort to get hold of the peer-review comments for the two papers Mueller had listed, both of which were rejected. Says Budowle: "We chased him from court to court to court until we finally got a judge to ask [Mueller] for the comments" last summer. Sighs Mueller: "They are all over the country now."

"If their peers have criticized them, we are entitled to know what the critics say. I think it is valid—but I don't think many scientists will," explains Harmon. And on that point, if nothing else, Mueller and Harmon would probably agree.

–Leslie Roberts

ing lights in U.S. genetics. Neufeld and Scheck brought in David Hagerman of the University of Colorado, Peter D'Eustachio of the New York University Medical Center, Conrad Gilliam of Columbia, and, in a real coup, Hartl and Richard Lewontin of Harvard, two of the nation's more prominent population geneticists. Prosecutor James Wooley, an assistant U.S. attorney with the Justice Department's Organized Crime Strike Force, might have seemed outmatched—he was, after all, trying his first DNA case. But he wheeled out some big guns of his own: Kenneth Kidd, a Yale population geneticist who had given up testifying as far too time-consuming but agreed when Wooley twisted his arm; Thomas Caskey, director of the Institute for Medical Genetics at Baylor College of Medicine and, at that time, president of the American Society of Human Genetics; and also Michael Conneally of Indiana University and Stephen Daiger of the University of Texas.

Much of the hearing was taken up with detailed back-and-forth on issues that have dogged DNA fingerprinting from the start: the criteria for determining whether two samples match, whether the laboratory conducting the analysis—in this case the FBI—did an adequate job, and whether national standards for conducting DNA analysis are needed. But in this case, Neufeld and Scheck zeroed in on an issue that has divided population geneticists: The statistical methods the FBI uses to judge the odds that a match could be a mere coincidence.

Hartl was to be the star witness, chosen by Neufeld and Scheck for his expertise—he was head of the genetics department at Washington University and the coauthor of a major textbook. Reluctant at first to testify, Hartl spent 4 months preparing, sifting through a 3-foot-high stack of documents and writing an expert report. He felt confident of his arguments as he entered the courtroom on 31 July.

Hartl focused on a seemingly straightforward question: Even if the analysis shows that DNA from the crime scene matches that from the defendant, what is the chance that it could be from two different individuals? Hartl argued, as did Lewontin in his stint on the stand, that the way the FBI computes the odds—essentially by multiplying together the frequencies with which each of several DNA markers occurs in a given population—is terribly misleading (*Science*, 20 December 1991, p. 1721). This approach, they argued, discounts the strong possibility that among particular ethnic groups, specific DNA patterns could be inherited together, much like blond hair and blue eyes and fair skin. If so, the odds of a chance match could be far higher than the FBI calculates. Because few population data exist on the new DNA markers, Hartl cited data from a well-studied blood group marker, called MN, which he said were highly reliable.

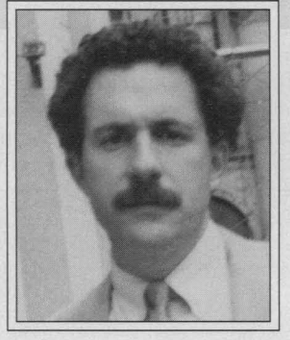
Not so, argued Wooley, who set out in his exhaustive cross-examination to show that the MN data were, in fact, notoriously unreliable. "It was an easy error to find. It was the only raw data he had compiled for the hearing. In an afternoon, we found six papers that said it is ridiculous," says Wooley, who was aided in the process by several scientists who testified for the prosecution. On the stand Wooley walked Hartl through the mistake slowly, tortuously, forcing him to concede his error repeatedly. Hartl defended himself by explaining that he is not a serologist and that his only mistake was in taking at face value data he read in a book. Although he admitted he had chosen a bad example, he insisted that it did not undermine his conclusion.

But what might be an embarrassing, if excusable, scientific error proved fatal on the stand as Wooley kept hammering away, using that one mistake to undermine Hartl's entire testimony. Says one prosecution witness: "It was very painful to watch him having to go through it. I felt very sorry for him." Hartl calls the experience "harrowing" and "emotionally draining," and at the end of the hearing, he was clearly shaken, telling the judge he doubted he would testify again. "I never expected it to be so adversarial," he told *Science*.

To Wooley, Hartl's protestations are naive, and he offers no apologies "for treating him like any other prosecutor in the world would have. I cross-examined him hard, but he deserved it," he told *Science*. "The MN data are fatally flawed. He is testifying for three Hell's Angels who murdered a kid. What does he think I am going to do, walk up and kiss him?"

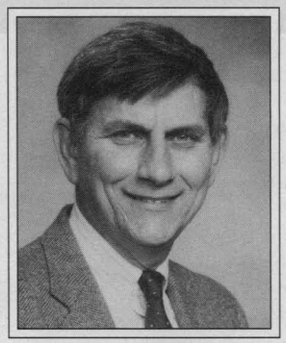
"I think there is a lack of appreciation on [Caskey's] part of the nature of the adversary system."

–Peter Neufeld



"I am being criticized for winning a competitive grant, as if it were dirty money."

–Thomas Caskey



And that was not the end of Hartl's troubles on the stand. Wooley also impugned Hartl's motives for testifying in the first place. Wooley painted him as an arrogant man who had been cleverly manipulated by the defense lawyers and was motivated by petty anger. (The defense lawyers had shown Hartl some scathing comments, made by the FBI's DNA expert Bruce Budowle, about *Drosophila* geneticists who wade into courtroom disputes.) And since the hearing, an issue that has dogged Hartl is his fee: He was paid more than $28,000 for his expert testimony and research, which Wooley says makes him the "highest paid single court witness" in DNA fingerprinting (see box, p. 735). Though Wooley did not mention Hartl's fee in the hearing, since then, he and the prosecutors in the network rarely miss the opportunity to get a dig in. Hartl insists that he was simply being compensated for his time, but he concedes that the sum undermined his credibility.

Wooley's courtroom tactics proved extremely effective: When the judge, James Carr, eventually ruled in October 1990 on the admissibility of the DNA evidence, he barely mentioned Hartl's testimony in a lengthy decision. Although Carr criticized the "remarkably poor quality of the FBI's work and infidelity to important scientific principles," he admitted the DNA evidence into court. Yee, Bonds, and Verdi were subsequently convicted of federal weapons violations, a verdict they have appealed, and they are about to stand trial in Ohio for murder.

Caskey's bruising victory

But if Hartl lost in the legal arena, Caskey, his scientific opponent, fared no better in a personal sense—though at the time he appeared to be the winner. Compared with Hartl, Caskey's stint on the stand was a breeze. Although he was offended when Neufeld and Scheck asked him about his wife's position in a biotech firm and his potential biases, he emerged unscathed. Indeed, the judge relied most heavily on Caskey in sorting through the difficult statistical issue, even though Caskey is not a population geneticist. Carr said he was was especially struck by the fact that Caskey has his own forensic lab at Baylor and uses an approach quite similar to that of the FBI. More than any other witness, he said, Caskey had laid his personal reputation on the line. But within a year and a half of that decision, Caskey's star was tarnished—and the mudslinging intensified—when

Neufeld and Scheck sought to reopen the debate over the admissibility of the DNA evidence by filing a motion for a new trial.

The catalyst was a scientific paper written by Lewontin and Hartl, based on their testimony in the *Yee* case. After the two geneticists failed to persuade the judge, they decided to take their complaints about the FBI's methods to a courtroom of their choosing—a scientific journal—sending in a paper to *Science* in June 1991. Nothing remains secret in the close-knit world of DNA fingerprinting for long: Almost as soon as Lewontin and Hartl's article was accepted by *Science*, galleys were in the hands of prosecutors and prosecution witnesses across the country. The leak stemmed from Hartl, whose postdoc sent the galleys to a defense witness in another case without knowing, he says, that he was planning to introduce the article in court.

Because the courts place special weight on peer-reviewed articles, the prosecution and its scientific allies mobilized to blunt the paper's impact on future court cases. In a move he would come to regret, Wooley called Hartl in early October 1991 to "lobby him" not to publish the article, which he considered ill-conceived. Wooley describes it as an amiable chat; Hartl describes it as a chilling experience in which Wooley attempted to intimidate him.

In mid-October Caskey and Kidd, who had both gotten hold of the paper, cornered one of *Science*'s editors at a genetics meeting and urged her not to publish it without a rebuttal. *Science* editor Daniel Koshland agreed, commissioning a rebuttal by Kidd and Ranajit Chakraborty of the University of Texas, which was published in the same issue. Koshland also called Lewontin a few days after the genetics meeting, asking for revisions in the paper, which was already in galleys. Lewontin hit the roof, and a story of innuendo and intrigue hit the front page. Lewontin and Hartl charged that the Justice Department was trying to suppress publication of the paper and that Koshland

Hired Guns or True Believers?

The charge most frequently lobbed by prosecutors and officials at the Federal Bureau of Investigation against expert witnesses for the defense in DNA fingerprinting cases is that they are hired guns—scientists with questionable credentials who travel from courtroom to courtroom simply to make a buck. "It's a real scandal what these guys get paid. If you knew, it would make your head spin," says Rockne Harmon, an Alameda County prosecutor who spearheads a nationwide effort to defeat the courtroom critics of DNA. Adds James Kearney, head of the FBI's Forensic Science and Training Center in Quantico, Virginia: "There are some who are making a living out of this. We resent them."

The targets of these attacks are, most often, population geneticist Laurence Mueller of the University of California, Irvine, biochemist and consultant Simon Ford, and molecular biologist Randell Libby, an assistant professor at the University of Washington. Mueller, who has testified about once a month for the past few years, made more than $60,000 in 1991—significantly more than what he pulls in as an associate professor. Ford has now set up his own consulting firm and derives all his income from advising the defense in DNA fingerprinting cases. Libby—"the all-time money maker" in Harmon's book—says he made about $80,000 testifying and consulting in 1991. And for preparing for and then testifying in a single case, Daniel Hartl of Washington University received more than $28,000—a figure that raised eyebrows even among friends. Richard Lewontin of Harvard University, who testified in the same case and later coauthored an article with Hartl for *Science*, was shocked to learn how much Hartl had been paid. "What? I am having a hard time not dropping the phone. $28,000? I thought these guys got $1,000 or so."

But does the fact that the witnesses are paid mean they will say whatever the lawyers want rather than what the science dictates? If so, then the same charge could be leveled at scientists who testify for the prosecution, who are also paid, often quite handsomely as well. Ranajit Chakraborty of the University of Texas, for instance, appeared 14 times in the past year and a half, bringing in $3,000 to $4,000 a case. And Michael Conneally of Indiana Univeristy, who generally bills $1,000 per case, has appeared about as often as the most persistent defense witnesses—once a month for the past 4 years.

In fact, witnesses on both sides charge roughly the same amount—$150 or $200 an hour, and perhaps $1,000 a day if they are out of town, plus expenses. Defense witnesses, however, do tend to rake in far more per case, in general because their job is harder. The prosecution witnesses often simply discuss the soundness of the underlying science—testimony that varies little from trial to trial. The defense, on the other hand, must scour the data, looking for any errors that could undermine the DNA evidence.

"I always bring it [how much I make] up in court," says Ford, who notes that his consulting business is unique—all the other experts have academic positions. "It is up to the judge to decide if I am a hired gun,'" says Ford, who adds that his salary "is not an astronomical amount of money."

At least one judge who has followed this and other courtroom brawls over science believes that in the DNA fingerprinting arena, there are no hired guns. "These are men and women of good faith on both sides, who feel strongly and testify truthfully as they see it," says the judge, who requested anonymity. He adds it is perfectly reasonable to be compensated at $200 an hour, or $50,000 a year. "Remember," he told *Science*, "a good defense lawyer is making $400 an hour, sometimes more."

As for their credentials, the targets of the most vociferous attacks are mostly fairly junior, assistant professor or associate professor level, and admittedly not yet world-class scientists. But to one scientist who follows the courtroom fights, the question is irrelevant. "Arrayed on both sides of the question you have a quorum of very, very distinguished people. Whether each and every member is a world-class scientist doesn't matter. This is a real scientific debate."

To Eric Lander, a population geneticist at the Whitehead Institute who testified once for the defense and now refuses to take sides (he appears as a court's witness instead), the constant harping about hired guns is just one tactic of many that lawyers on both sides use to discredit scientists who oppose them. "People are trying to distract attention from the substance of the science. People are looking for personal motives here, everything from making money to avenging criticism is being used to explain why someone would express a scientific opinion. The obvious explanation is because they believe it."

Even so, Lander and others, including Lewontin and population geneticist Jerry Coyne of the University of Chicago, refuse to accept money for their courtroom work—Lewontin because he believes it is wrong: "One appears as a matter of principle. It is our obligation as scientists to do it. I don't think we should be paid." Others decline the fees largely because they know they can be used to undermine their credibility. Says Lewontin: "I think your credibility is damaged no matter what you do. If the attorney asks if you are paid, you answer yes, they invoke a hired gun. If you say no, the question is, are you a zealot with a political agenda?"

–L.R.

had caved into government pressure. Koshland says he was not contacted at all by the Justice Department and that he simply wanted a balanced presentation of the issues.

For his part Caskey says, "I feel quite happy with having gotten both points of view published." Even so, Caskey paid a high price. In news stories on the flap, *Nature* reported that Caskey had licensed his PCR(polymerase chain reaction)-based DNA profiling technology to Cellmark, one of the major DNA fingerpinting laboratories, and *The New York Times* noted that he has a $200,000 grant from the National Institute of Justice (NIJ)—disclosures that were quickly used to challenge Caskey's objectivity. (Neither publication, however, looked at the prosecution's allegations about the defense witnesses.)

In a sworn affidavit and in an interview with *Science*, Caskey insists that he has not personally profited from either arrangement. The Cellmark deal brings Baylor $15,000 a year through BCM Technologies, the school's licensing outfit, and at first about $1,400 of that went to Caskey's department. But once the stink broke, he says, he signed it over to the graduate school. As for the NIJ grant, he says, "I am being criticized for winning a competitive grant, as if it were dirty money."

Nevertheless, at a December 1991 meeting of a National Academy of Sciences (NAS) committee that was drafting a report on DNA fingerprinting, of which Caskey was a member, Eric Lander of the Whitehead Institute, who had often been at odds with Caskey on scientific issues, pushed for Caskey to resign, as did Mary-Claire King of the University of California, Berkeley, and Jack Weinstein, a federal judge in New York. Says one member: "None of us thought it affected his judgment on the committee. Nonetheless, the appearance was not good, so it was appropriate that he step down." Caskey agreed—voluntarily, he emphasizes. "I did the right thing for the committee; Lord knows if I did the right thing to me," Caskey told *Science* shortly after the meeting, when he predicted—rightly it turns out—that his resignation would provide ammunition for his courtroom adversaries.

Typically—if this were not DNA fingerprinting and Caskey were not an expert witness—the matter would have ended there. But Neufeld and Scheck continued to bore in on Caskey's potential conflicts. In February, they filed a motion for a new trial, and in lengthy documents submitted to the judge—and released to reporters—Neufeld and Scheck dissected Caskey's motives, ego, biases, and hypothetical future business dealings in great detail. They accused him of intentionally misleading the court by saying he had no prospect of financial gain from the fingerprinting technique he was developing, all the while knowing he had a marketable product and, indeed, would license it within several months. They blast him for an "ethical breach" in not revealing that he had applied for the NIJ grant.

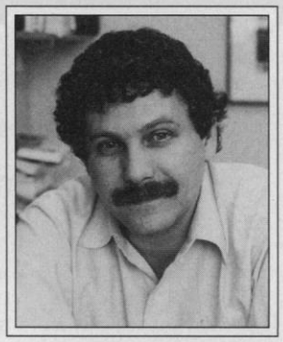
Caskey was not alone. Neufeld and Scheck also blast Daiger for not revealing that he had a sizable grant from the NIJ. They accuse John Hicks, the head of the FBI's Laboratory Division, of attempting to tamper with the NAS report by writing to the committee staff with his criticisms of a draft that two committee members had leaked to the FBI. They attack *Science* and the *American Journal of Human Genetics* for being in collusion with federal law enforcement agencies. They slam Kidd for failing to disclose data that they claimed contradict his own testimony.

Caskey says he is convinced that Neufeld has set out to destroy his professional and personal reputation simply because his scientific views have prevailed in court. He adds: "This is undoubtedly one of the most stressful things I have gone through. I can't tell you how painful it has been."

"I am sorry he feels that way. I have no personal feelings one way or another about Dr. Caskey," counters Neufeld. "His reputation is that of a first-rate scientist who has contributed much to society. Nonetheless, his role in this particular issue raises serious questions of professional judgment." And it is a lawyer's job, Neufeld points out, to ferret out anything that might prejudice the view of an opposing witness. "I think there is a real lack of appreciation on his part of the nature of the adversary system."

"When you try to manage the quality control of scientific evidence, the legal system is a very, very blunt instrument."

–Eric Lander



Alien worlds

Caskey and Hartl are just two of numerous expert witnesses who had their noses bloodied in the courtroom battle over DNA fingerprinting. Even some old hands agree that in the past year this dispute has gotten out of hand. "This is no [longer] a search for the truth, it is a war, the way people are behaving," says the FBI's Hicks.

After a bruising encounter on the stand, it is easy to blame the lawyers, who are cast by scientists on both sides as unscrupulous manipulators who resort to character assassination when the facts fail them. To the lawyers also goes the lion's share of the blame for keeping alive a scientific dispute that could undoubtedly have been resolved by now in a nonadversarial setting. But the lawyers are in fact just doing their jobs. Indeed, much of the nastiness the scientists bemoan is simply the inevitable result of the head-on collision of two such disparate worlds, of science and law, with their different assumptions, norms, and rules of behavior.

Some expert witnesses, like Hartl, balk at the nastiness and swear they will never testify again. (Hartl did, however, have a change of heart: He recently provided advice in *Minnesota* v. *Martin Estrada Perez*—for the prosecution, which finally, he says, employed sound statistics.) Others see the battle scars as the price of admission if they want to weigh into scientific disputes in the courtroom. One of those is King, the Berkeley geneticist, who believes that it is essential for scientists to point out both the potential and pitfalls of this new technology. Says King, who has testified for both the prosecution and the defense: "I find it a little childish that people with the intellectual capability to carry out this work can't cope with the hassle. If scientists are going to testify, they had better expect to be treated like any other witness."

But inevitable or not, scientists and lawyers alike agree that science is not well served by such courtroom brawls. "This controversy points out one thing: When you try to manage the quality control of scientific evidence, the legal system is a very, very blunt instrument," says Lander, who served as a court's witness in the *Yee* case.

What are the alternatives? Lander cites the 1989 *People* v. *Castro* case, in which the defense witnesses—he was one—and the prosecution witnesses met outside the courtroom and hammered out their differences, issuing a joint statement to the court—an example Neufeld lauds as well. Says Lander: "What was so amazing about *Castro* is we all got out of the courtroom and found there was a hell of a lot we could agree on."

In April the NAS committee proposed another alternative, a new national committee on forensic DNA typing that would vet new technologies before they make it into court—and before the battles begin (*Science*, 17 April, p. 300). So far, however, there is no sign that Congress is moving to implement the scheme. The NAS report also went a long way toward resolving the statistical issues that so divided witnesses in *Yee*, but still, the fight seems far from over. The second generation of DNA fingerprinting technology is just coming on line, which portends a whole new set of battles—and perhaps a new cadre of expert witnesses—drawn into the fray.

–Leslie Roberts