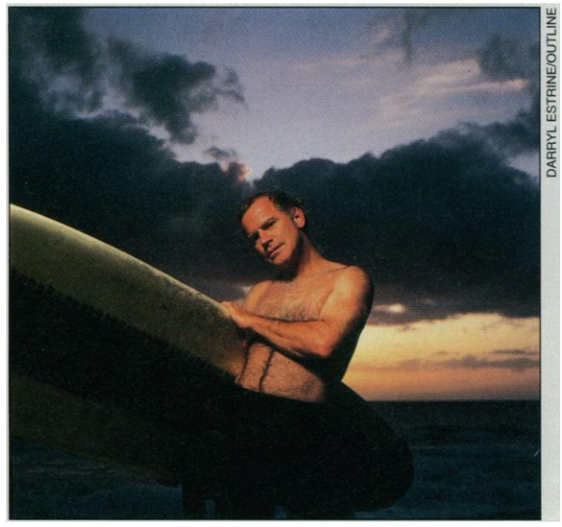
FORENSIC DNA

Genes and Behavior Make an Appearance in the O. J. Trial

The interminable murder trial of former football star O. J. Simpson last week moved on to a discussion of the critical scientific issues in the case: analysis of DNA from blood samples that allegedly tie Simpson to the murders of his ex-wife Nicole Brown Simpson and her friend Ronald Goldman. As the legal-scientific debate began, however, the spotlight was not on the evidence, but instead was focused on the personal life of a high-profile scientist whom Simpson's lawyers may call as an expert witness—Nobel laureate Kary Mullis, inventor of the polymerase chain reaction (PCR) technique for amplifying DNA.

Mullis's character became an issue on 27 March, when prosecutors filed a motion with Judge Lance A. Ito attacking Mullis's "credibility, competency, and sobriety." The motion also noted that Mullis has never published a scientific article regarding his reservations about DNA evidence. This no-holds-barred assault on his credibility has been widely viewed as an effort to blunt the impact his Nobel might have on the jury.



DARRYL ESTRINE/OUTLINE

A question of lifestyle. Prosecutors attacked Kary Mullis's credibility as an expert witness for the defense.

The prosecution has good reason to be concerned about the persuasive powers of a Nobel Prize. Mullis has testified in pretrial hearings in two previous cases, and in both the judge sided with Mullis, declining to allow DNA evidence to be presented to a jury if PCR was used to identify a defendant. William Yoshimoto, a prosecutor in Visalia, California, who cross-examined Mullis in one of those cases, a double-murder trial, says: "His position was out-of-date with current technology. Unless he's done significant research since he testified here, I don't think he's got a leg to stand on." But, says Yoshimoto, "the judge in our case was impressed that [Mullis] had a Nobel Prize." Even in that case, however, Mullis's efforts did not prevent conviction. The judge allowed DNA evidence implicating the defendant that did not rely on PCR; the defendant was found guilty and given a sentence of 52 years to life.

As Judge Ito noted, the motion filed last week is "a pre-emptive strike." Deputy District Attorney Rockne Harmon, who signed the motion, makes clear that the prosecutors do not believe the defense wants to put Mullis on the stand. Instead, the motion contends that defense attorneys plan to introduce Mullis's views into their cross-examination of prosecution witnesses. This strategy would inform the jury that a Nobel laureate disagrees with the way his own invention is being used, but would not give Harmon a chance to challenge Mullis's views directly by cross-examining him.

Howard Coleman, co-author of *DNA in the Courtroom* and a frequent expert witness himself, says that if Mullis takes the stand "it'll be a big mistake." Coleman, who dropped out of a graduate program in molecular biology to start his own DNA testing lab, GeneLex in Seattle, predicts Harmon would "shred" Mullis.

Mullis could not be reached for specific comment about the prosecutors' motion. But he was interviewed by *Science* early last month about the Simpson trial. Although he would not discuss the details of his potential testimony, he said he has no opinion about Simpson's guilt or innocence.

If the Simpson defense does call Mullis to the stand, he is expected to echo common criticisms of forensic use of PCR: Samples are vulnerable to contamination, and, even if the analysis is done properly, there is a remote possibility that an innocent defendant's DNA fingerprint could coincidentally match the true perpetrator's. But, based on his testimony in two previous cases, a central part of Mullis's argument likely will be a novel contention that a better DNA technique exists and isn't being used.

Although some blood samples in the Simpson case contained DNA of sufficient quantity and quality to be analyzed without using PCR, the bulk of the samples required PCR to amplify stretches of DNA (*Science*, 2 September 1994, p. 1352). In forensics tests, PCR is used to amplify genes that are polymorphic, meaning they vary from person to person. For example, there are 21 different genotypes for the cell surface molecules known as human leukocyte antigens, and each genotype appears with a different frequency in a given population. The more known polymorphic genes, or loci, scientists are able to amplify in a blood sample, the more precisely this method allows them to identify an individual. The Simpson case is analyzing seven loci with PCR.

Mullis has testified before that this strategy has an inherent weakness: It doesn't uniquely identify a person. Rather, it calculates a probability—say, 1 in 10,000—that two people will match coincidentally. In two trials last year, Mullis argued that it would be better to focus on DNA found in mitochondria rather than chromosomal DNA. Mitochondrial DNA, which is passed only from mother to child, has two highly variable regions, and Mullis testified that sequencing the base pairs that make up the genetic code from these regions would provide a unique genetic profile. Other than maternal relatives, Mullis said at one trial, "a DNA sequence from somebody at, say, 200 base pairs of sequence would identify the person uniquely."

But two of the world's authorities on the forensic use of mitochondrial DNA disagree with Mullis. "That's incorrect," says Mark Stoneking, an anthropologist at Pennsylvania State University. "We have cases in databases where two people with no maternal link have matching mitochondrial DNA for *more* than 200 base pairs." Mitchell Holland, a biochemist with the Armed Forces Institute of Pathology who uses mitochondrial DNA sequencing to identify remains of soldiers, says the most frequent mitochondrial DNA sequence they see appears in 3% of the population. Both Stoneking and Holland stress that mitochondrial DNA sequences are powerful identifiers, but ultimately they are just another locus. " 'The more genetic loci, the better' is always what people are striving for," says Holland.

The prosecutors have served notice that, if Mullis does take the stand for the Simpson defense, the prosecution will try to get the jury to look beyond Mullis's Nobel Prize—and into what they think are less savory aspects of his life. The motion says Mullis's "personal and professional life have caused many members of the scientific community to disregard his opinions about forensic PCR applications." It asserts that he "freely admits" he is "a long time drug (LSD) user/abuser," does not think HIV causes AIDS,

and "has accused the scientific community of engaging in fraud, and has admitted doing so himself." The motion prompted a flurry of media reports, and 2 days later, the *Los Angeles Times* reported that Mullis pled guilty in 1990 to domestic violence charges. Court documents show that the charges, which were filed by a girlfriend, were dismissed after Mullis agreed to see a therapist and attend Alcoholics Anonymous meetings.

At a 30 March hearing about the motion, Simpson attorney William C. Thompson, a professor of criminology at the University of California, Irvine, who specializes in DNA forensics, upbraided the prosecution for dragging Mullis's reputation through the mud. "This motion, with its disparaging comments about Mullis, is particularly disturbing to us, because we view it as part of a continuing course of conduct by Mr. Harmon designed to intimidate scientists," said Thompson. In spite of such complaints, Thompson himself wasn't above using similar language in describing Harmon to *Science* as "the snarling dog that protects the junkyard of forensic science."

But those who know Mullis don't think he's intimidated. In fact, they say, they think he would relish a confrontation with the prosecution in open court. "As a witness, he's going to love it," predicts Donald Thommen, a California defense attorney who hired Mullis last year in the double-murder case. "He'll really play it up if he gets on national TV. He's got a big ego. The jury's going to love it, too."

Indeed, although Mullis steered clear of discussing the specifics of the trial with *Science*, he minced no words about Harmon. "He thinks he knows something 'cause he's read some pamphlets about DNA or something," claimed Mullis. If Harmon delves into personal issues, vows Mullis, he'll bite back. "If they want to make it an issue, I'll be really feisty with them," said Mullis. "I certainly won't lie down and die for them. Harmon will have met his match." Harmon, who is well-known for his combative cross-examinations (*Science*, 7 August 1992, p. 733), assured in his motion that the confrontation would be "a lively event!"

And so it goes, as the "Trial of the Century" lurches into the realms of science—and character—with no end in sight.

–Jon Cohen

SCIENTIFIC EVALUATION

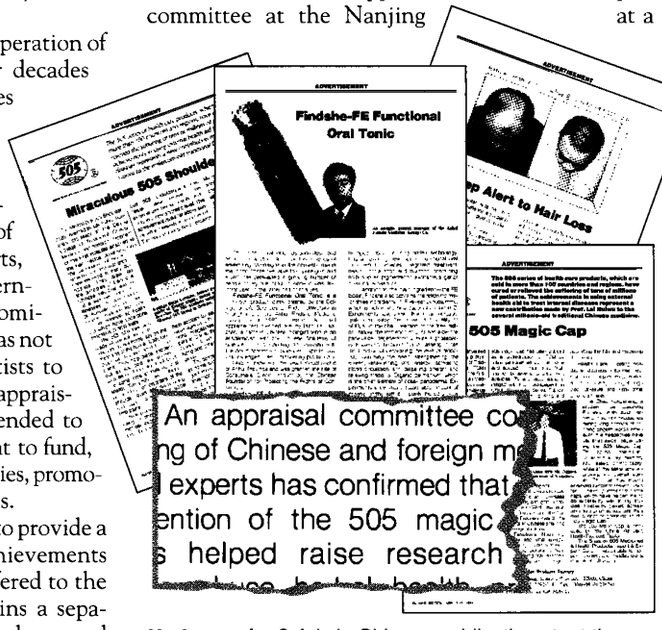
China Tightens Appraisal System

BEIJING—China has adopted a new system to evaluate scientific and technical achievements that is expected to reduce cronyism, improve the quality of the reviews, and give more weight to market forces in judging the commercial value of new technologies. The new procedures, enacted earlier this year by the State Science and Technology Commission (SSTC) and hailed by scientists, also give scientific journals, through their publication decisions, a larger role in determining what basic research is worthy of continued funding.

The key changes involve the operation of appraisal committees, which for decades have shaped the professional lives of Chinese scientists. Any work tied to a government plan—and in a socialist economy that has meant practically everything—had to be judged by a committee of half a dozen or so scientific experts, assembled by the relevant government body. Researchers could nominate their own reviewers, and it was not uncommon for prominent scientists to perform as many as 30 to 50 such appraisals a year. The reviews were intended to help the government decide what to fund, and the results also influenced salaries, promotions, and even housing allocations.

The system was also supposed to provide a seal of approval for technical achievements before they were put to use or offered to the public. Although China maintains a separate system for approval of new drugs and medical devices, a positive appraisal was something that companies could put into their advertising as additional proof of the quality of their product. In practice, however, it often produced exactly the opposite effect: Shoddy goods flooded the market accompanied by wildly inflated claims of efficacy, as appraisers were either too busy or too afraid of offending powerful colleagues to exercise proper scrutiny over the quality of the work.

In one case reported last year by the government-run *Science and Technology Daily*, a device to measure the sulfur dioxide content of industrial emissions, funded by the Chongqing Environmental Protection Bureau at a cost of $3.4 million, passed its expert appraisal but nevertheless failed to perform. The problem, according to the news account, was that an appraisal committee at the Nanjing Chemical Industry Research Institute used pure sulfur dioxide rather than actual boiler smoke to test the device. A report based on these meaningless results was sent to the environmental agency, and, despite the absence of signatures from any committee members, the device was approved.



Undue praise? Ads in Chinese publications tout the approval of appraisal committees.

China's market for health care products and medicines has been especially vulnerable to exaggerated, if not fraudulent, claims. Glowing appraisal reports have routinely been touted in advertisements in Chinese media for a wide range of bizarre concoctions and devices such as hair-growth preparations, health tonics, and herbal "health belts."

The new system is expected to reduce the number of appraisals, substituting "market competition and academic exchanges," explained Han Deqian, vice chair of the SSTC, at a Beijing press conference. He estimated that the number of appraisals conducted nationwide—33,000 last year—would drop by as much as 60%. Basic, theoretical, and social science research would no longer be required to undergo appraisals, he added, but appraisals will still be done in areas where, Han noted, "market mechanisms are not fully developed." For the rest, government agencies will accept the verdicts of journal editors as an objective measure of the quality of the research.

Officials at the SSTC say they hope that the changes, which also prohibit scientists from selecting their own appraisers and end mail reviews, will help end the endemic bribery and cronyism that plagued the old system. One prominent chemist at a Beijing research institute, who requested anonymity, says this widespread practice has become a major irritant for scientists. "It is very troubling when an old classmate or a close friend nominates you to appraise his research," he says. "You do not want to ruin a relationship by saying it is bad, but you cannot violate your integrity as a scientist by saying it is good when you know it really isn't." The only way out of this di-