A reader points out a major role for science and engineering suggested in the recently released U.S. House of Representatives report on national science policy. The role of the U.S. Department of Defense in funding academic basic research is lauded. Proposed animal experimentation regulation in India is discussed. Standards for expert engineer witnesses are debated. A reader writes: "Reliance on experience and judgment in decisions that affect lives of others sets engineering and medicine apart from science." And two views of who should own scientific papers are presented.

Environmental Decision-Making

David Malakoff's article (News of the Week, 2 Oct., p. 23) about the U.S. House of Representatives Science Committee's new report on national science policy (*1*) does not mention that the report calls for a fourth major role for science and engineering, in addition to national security, health, and the economy: "that of helping society make good decisions. We believe this role for science will take on increasing importance, particularly as we face difficult decisions related to the environment" (*1*, p. 5).

The organization and scope of the federal government's present efforts in science for the environment are far from optimal (*2*). Congressman Vernon J. Ehlers (R–MI), the principal author of this new report, has recognized the problem and has joined with 90 of his colleagues in bipartisan co-sponsorship of legislation to create a National Institute for the Environment (NIE) under the National Science Foundation, with a mission to improve the scientific basis of environmental decision-making (*3*). It is reasonable to expect that both Congress and the Administration will make serious efforts over the next couple of years to more effectively achieve the new goal of the emerging national science policy: improved science for decision-making on the environment.

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1. "Unlocking our future: Towards a new national science policy" (Interim report, House Science Committee, Washington, DC, 24 September 1998, www.house.gov/science/science_policy_report.htm).
2. Committee for the National Institute for the Environment, *Environ. Profess.* **16**, 94 (1994); *Environmental Research and Development: Strengthening the Federal Infrastructure* (Carnegie Commission on Science, Technology, and Government, Washington, DC, 1992); *Environmental Research and Development: Status Report and Recommendations* (Carnegie Commission on Science, Technology, and Government, Washington, DC, 1995); Committee on Environmental Research, National Research Council, *Research to Protect, Restore, and Manage the Environment* (National Academy Press, Washington, DC, 1993); National Commission on the Environment, *Choosing a Sustainable Future* (Island Press, Washington, DC, 1993).
3. H. R. 2914, Sound Science for the Environment Act; see also www.cnie.org

CREDIT: RENEE STOCKDALE

Animal Experimentation Rules in India

Pallava Bagla's article "Animal experimentation: Strict rules rile Indian scientists" (News of the Week, 18 Sept., p. 1777) implies that Indian scientists are against any "strict" rules because of the increased paperwork involved. We write to correct that implication. In fact, we are glad that a beginning has been made

The Indian scientific community asks that rules be compatible with good science.

on formal regulation of animal experimentation in India. All we have against the proposed rules are three procedural reservations:

1) The rules envisage a single central committee as the sole licensing body for all experimentation in a large country. Considering the foreseeable workload for a single agency, we ask that the committee decentralize and operate through several Institutional Animal Care and Use Committees (IACUCs). Bagla mentions, correctly, that the Indian National Institute of Immunology formed an IACUC only this summer. What he does not say is that this simply set up a single committee for animal use–related issues that institutional committees on ethics and biosafety dealt with earlier. In their hands, all our animal experiments have followed U.S. National Institutes of Health norms for years.

2) The rules demand prior approval for each individual experiment separately. We think that this is impracticable and instead suggest licensing humane protocols in scientifically approved research projects.

3) The rules effectively prohibit the acquisition of experimental animals from non-Indian sources. This denies Indian researchers access to international genetically defined animal strain resources. We urge allowing such acquisition.

We think our suggestions conform to the "well-established norms adhered to in the West" mentioned by Maneka Gandhi, as quoted in Bagla's article. Despite the contention of anti-science "animal rights" advocates who are mentors of the proposed rules, the Indian scientific community welcomes the rules. We merely ask that the rules be modified to be compatible with good science.

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DOD: A Critical Funder and Risk-Taker

Wm. A. Wulf's editorial (Science's Compass, 18 Sept., p. 1803), saying that the U.S. Department of Defense (DOD) "has become a critical funder of academic basic research," is extraordinarily timely, just when Congressman Vernon J. Ehlers (R–MI) has released a document on the future of American science (D. Malakoff, News of the Week, 2 Oct., p. 23). Indeed, DOD has always been that, ever since the Office of Naval Research started the concept in 1946. It is inconceivable that a national report could be written without emphasizing the absolute need to maintain DOD's basic research funding share as a key component of the national effort. A specific argument for DOD basic research is that it is the only part of the national system that proactively finds and supports outside-the-paradigm breakthroughs. In the 50 years of my "funded" life, neither I nor any colleague I know has found any other agency willing to take the risks that DOD takes on really new scientific discoveries.

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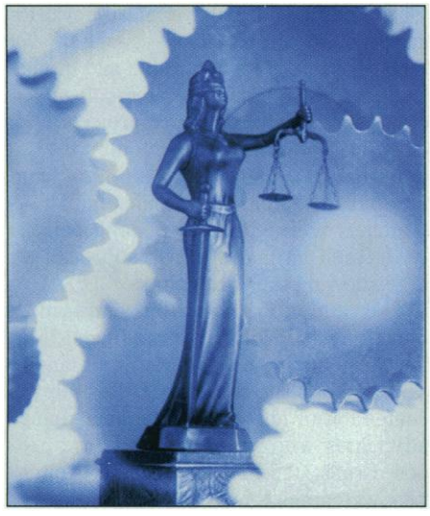
Standards for Engineer Witnesses

The article about the Supreme Court's pending case involving standards for expert witnesses, "Should engineer witnesses meet same standards as scientists?" by Jocelyn Kaiser (News of the Week, 11



Sept., p. 1578), suggests that the issue in that case, *Kumho Tire Co.* v. *Carmichael*, is whether the standards for admitting scientific expert witness testimony that the Court set forth in *Daubert* v. *Merrill Dow Pharmaceuticals, Inc.* (*1*) are applicable to engineering experts.

While the expert witness in the *Kumho* case was an engineer, he eschewed reliance on any engineering methods in forming his opinion. Rather, the expert, who had worked in the tire industry, relied on his experience in examining and analyzing tires that had failed. As the lower court in *Kumho* observed (*2*):

> [The expert] makes no pretense of basing his opinion on any scientific theory of physics or chemistry. Instead [he] rests his opinion on his experience in analyzing tires. After years of looking at the mangled carcasses of blowout tires, [the expert] claims that he can identify telltale markings revealing whether a tire failed because of abuse or defect.... [The expert] maintains that his experiences in analyzing tires have taught him what "bead grooves" and "sidewalk deterioration" indicate as to the cause of a tire's failure.

Thus, the *Kumho* case presents the question of whether a witness claiming expertise based on experience is to be evaluated by the criteria set forth in *Daubert*. *Kumho* does not address the question of whether a witness, relying on engineering principles, who testifies to an opinion, say, about how an automobile accident occurred, should be screened on the basis of the dictates of *Daubert*.

The challenge in *Kumho* will be whether the Supreme Court can identify certain areas of human endeavor in which valuable understanding is obtained through experience. This experience provides knowledge through a process quite different from rigorous empirical scientific investigation, but may nevertheless be of value in court, because it involves phenomena that scientists do not study because of cost, lack of interest, or their mundane nature. If the experience provides greater accuracy than we might otherwise obtain, it may, although unscientific, still be of considerable legal value.

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1. 13 S. Ct. 2786 (1989).
2. *Carmichael v. Samyang Tire, Inc.*, 131 F. 3d 1433 (11th Cir., 1997).

Kaiser's News article features the brief filed by the National Academy of Engineering (NAE) in support of the Kumho Tire Co. in *Kumho* v. *Carmichael*. Although I agree with the NAE's position regarding this particular expert's testimony, extending the criteria enunciated in *Daubert* v. *Merrill Dow Pharmaceuticals, Inc.* to all engineering expert testimony would be a serious mistake.

Engineering, like medicine, is based on science, but both fields transcend science. In products liability cases, such as *Kumho,* one must determine whether a defect caused the failure that resulted in injury, loss of life, or damage to property. Although *Daubert* criteria work reasonably well for manufacturing defects, they are inadequate for design defects. In design defect cases, judgment and experience, as well as science, determine feasibility, factors of safety, acceptable failure rates, and appropriate computer simulations. *Daubert* provides little guidance.

Reliance on experience and judgment in decisions that affect lives of others sets engineering and medicine apart from science. For this reason engineers and physicians are licensed to practice their professions, while scientists require no such license to practice their science. Historically, physicians, and later engineers, were licensed by the state to protect the public by limiting certain activities (such as cutting into people and designing and manufacturing pressure vessels) to holders of those licenses. In return for the state's granting licenses, the profession certifies qualified individuals and requires them to hold certain values paramount. For engineers, these values are life, health, welfare, and property of the public.

Perhaps the Supreme Court will restrict engineering and medical testimony to licensed engineers and physicians, while anyone with a scientific education (including engineers and physicians) can testify about science, subject to *Daubert* criteria for that part of their testimony.

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Kaiser does not point out the vital point that the Supreme Court made in the *Daubert* v. *Merrill Dow Pharmaceutical, Inc.*: "in order to qualify as 'scientific knowledge' an inference or assertion must be derived by the scientific method." The scientific method is a general method applicable to all fields that seek reliable knowledge. Thus, all expert witnesses should be obligated to show that they have used the scientific method in arriving at the conclusions they provide in their testimony and assertions.

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The Copyright Issue

I found the article by Steven Bachrach *et al.* about ownership of scientific papers (Policy Forum, *Science*'s Compass, 4 Sept., p. 1459) eye-opening and enthusiastically endorse their proposal that the copyright of articles of research done with the financial support of federal agencies should remain with the authors of the work.

Floyd E. Bloom (Editorial, 4 Sept., p. 1451), expanding on a point acknowledged by Bachrach *et al.*, emphasizes that *Science* adds value to the papers that it publishes through its editorial involvement (which is substantial relative to most journals and which I have found generally very helpful, although that is not a universally held opinion among authors of my acquaintance), through the publicity that derives from its large readership (which is greatly to every author's liking), and through electronic archiving. Bloom states, "This degree of investment in the scientific publication process requires the assignment of copyright."

I disagree. The tangible investment in communicating science largely consists of the cost of doing the work. Even when *Science* materially improves the product that it publishes, referring to it as "create[d] together" with authors to the extent that ownership necessarily belongs to the publisher is excessive. It is, moreover, difficult to assert necessity of ownership when it is ceded to sufficiently powerful entities such as the U.S. government and sundry private corporations.

Science should extend the privilege of copyright ownership to all authors of its research articles, regardless of financial support or country of origin.

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I would like to suggest a simple solution to the problem of copyright assignment for scientific articles: Authors should only assign rights when they believe that they are getting an adequate added value in return.

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