law. Juries should not be asked to do the impossible. It defies logic to argue, as Wagner does, that lay jurors can somehow answer the unanswerable.

Indeed, one is hard pressed to imagine what would constitute "trans-scientific" evidence and what a jury would do with it. I can think of three scenarios. First, an expert witness might testify, on the basis of unproved and rejected theories like clinical ecology (*3*, pp. 689–691), that the exposure at issue did in fact more likely than not cause the disease at issue. Because such testimony is patently out of keeping with accepted scientific practice, it could only mislead and confuse a jury, and it should not be admitted. Second, a witness might present data or research results, along with speculative conclusions about ill-defined and completely unquantified potential risks associated with the exposure; but if the expert cannot reach a more definitive conclusion, nonexpert jurors can hardly be expected to do better. Finally, an expert might validly conclude that there is some chance, but less than 50%, that the exposure caused the disease. The jury would then have to reinterpret this testimony to find that it somehow satisfies the legal "more likely than not" requirement; but again, if the expert cannot reach this conclusion, there is no rational reason to think that a jury could.

The examples cited by Wagner bring no clarity to her argument. They demonstrate no need for relaxing the rules of evidence. Plaintiffs regularly win asbestos, Dalkon Shield, and diethylstilbesterol cases, and regularly won swine flu vaccine cases, using science, not trans-science. Wagner laments the fact that people were injured before the problems with these products were discovered, but her solution would convert virtually any vague "trans-scientific" speculation into the basis for a lawsuit. Her solution would also radically change tort law by making companies pay for countless illnesses and injuries that would have occurred even if the companies had never made the accused products.

Wagner would solve a largely nonexistent problem with a totally unwarranted reshaping of the law. She may be impatient with the limitations of science, but impatience does not justify the relaxation of both scientific and legal standards. Trans-science is not science, and it has no place in the law.

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REFERENCES AND NOTES

1. Rule 706 of the Federal Rules of Evidence allows a court to appoint an expert witness of its own selection and to have the parties pay the cost.
2. B. Black and D. E. Lilienfeld, *Fordham Law Rev.* **52**, 732 (1984).
3. B. Black, *ibid.* **56**, 595 (1988).

Mathematics Achievement

Colin Norman's article "Math education: A mixed picture" (News & Comment, 22 July, p. 408) gives a misleading impression of both the source of the deficits in mathematics achievement of black and Hispanic students and the educational policies required to correct the deficits. When grade equivalent units are used to report scores on achievement tests, one's expectation is that groups with lower means in an early grade will fall farther and farther behind with progression up the grades. This expectation derives, however, from the nature of the grade equivalent units of measurement for which variances in racially homogeneous populations increase markedly with grade (and age) for all kinds of academic achievement. Variances of measures of physique also increase during the grade school years and reflect primarily normal physical growth, not nutritional differences.

To determine whether a minority group is falling farther behind majority whites during the school years, it is more defensible to use a standard score scale. This scale reveals whether the relative position of an individual or subgroup in the total sample changes as grade or age increases. In standard score units academic or intellectual deficits that appear early, including those appearing in preschool, tend to remain constant. In a particular instance, if standard score means do draw apart, one can be reasonably certain that there is a real "falling behind" phenomenon.

In spite of an initial disclaimer to the contrary, Norman also discusses correlations of students' mathematics achievement with attitudes of parents, teachers, counselors, and the students themselves as if those correlations represented causal relations. Describing the correlations of parental attitudes and encouragement with children's performance in mathematics as the former having "the strongest influence" or the correlation of the student's own liking for the subject with performance as the former being an "important factor" should be avoided. Educational changes based on inferences concerning causation from mere correlations are likely to be fruitless.

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Norman reports the finding of the National Science Foundation that "the disparity [between boys and girls on standardized mathematics tests in high school may be] unique to the SAT [Scholastic Aptitude Test, Mathematical] itself." Our data indicate that this is not correct. Although girls tend to achieve at least as well as boys on in-school tests, even in most of the subjects where they are getting better grades than boys they tend to average less on nationally standardized tests. Some mean difference results favoring males, in standard deviation units, for large numbers of cases are: Preliminary Scholastic Aptitude Test, Mathematical, 0.37; American College Testing Program Mathematics, 0.34; College Board Achievement Test, Mathematics Level I, 0.39, Level II, 0.38, and Physics, 0.59; Advanced Placement Program, Calculus Level AB, 0.20, Calculus Level BC, 0.18, and Computer Science, 0.50; quantitative score of Medical College Admissions Test, 0.37; quantitative score of Graduate Management Admissions Test, 0.43; Graduate Record Examination, Quantitative, 0.67, advanced test in mathematics, 0.71, and advanced test in political science, 0.76 (*1*).

Whereas most of these mean differences are not huge, there can be strong effects when applicants are selected partly because of their high test scores. For example, the ratio of males to females taking the computer science test is about 5.7 to 1, and even among the examinees twice as large a percentage of males as of females score 4 or 5 on the 5-point scale. For the European History test of the College Board Achievement Tests (effect size 0.63 in 1985) the examinee ratio, favoring males, for scores of 700 or more was 5.2.

We now know a great deal about the existence and magnitude of differences between males and females on at least 86 nationally standardized cognitive tests, but little about why they occur and how to lessen them. Current data provide promising leads for research about the whys and hows.

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REFERENCES

1. J. C. Stanley, "Sex differences on cognitive tests: A summary," paper presented at the annual meeting of the American Educational Research Association, Washington, DC, 24 April 1987; C. P. Benbow and J. C. Stanley, *Am. Educ. Res. J.* **19**, 598 (1982); *Science* **222**, 1029 (1983).

Erratum: In Leslie Roberts' article "New targets for human gene therapy" (19 Aug., p. 906), the collaborators from Tufts–New England Medical Center were unintentionally omitted. They are David E. Johnston and Douglas M. Jefferson.