LETTERS TO THE EDITOR

Letters are selected for their expected interest for our readers. Some letters are sent to reviewers for advice; some are accepted or declined by the editor without review. Letters must be brief and may be edited, subject to the author's approval of significant changes. Although some comments on published articles and notes may be appropriate as letters, most such comments are reviewed according to a special procedure and appear, if accepted, in the Notes and Discussions section. (See the "Statement of Editorial Policy" in the January issue.) Running controversies among letter writers will not be published.

ON THE PROBLEM OF DEGENERACY IN QUANTUM MECHANICS

It may be worthwhile to point out that the recent paper by X. L. Yang, M. Lieber, and F. T. Chan, "The Runge–Lenz vector for the two-dimensional hydrogen atom" [Am. J. Phys. **59**, 231–232 (1991)] presents a solution that was published more than 50 years ago by Jauch and Hill "On the problem of degeneracy in quantum mechanics," [Phys. Rev. **57**, 641 (1940)]. Jauch and Hill's paper also discusses the harmonic oscillator problem from a group theoretical point of view and is very instructive.

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15 March 1991

ARE MALES BETTER AT MATHEMATICAL REASONING AND IF SO, WHY? A REPLY TO RUSKAI

Professor Ruskai's[1] denial that there is a physiologically based male mathematical advantage fails on purely logical grounds

(1) The fact that there are tests that find no male–female difference is irrelevant. The empirical reality to explain is the consistent difference on the tests that *do* find a difference; that *different* tests do not find a difference means only that these tests are insufficiently sensitive or test a different aptitude. A null finding on one test can never cancel a non-null finding on a different test.

(2) The fact that the difference of male and female means on the relevant tests is "small" is irrelevant. A "small" difference in means often—as in the case of height—complements a huge difference at the extremes.[2]

(3) The fact that male and female mathematics students get the same mathematics grades at MIT is irrelevant. In response to a recent *New York Times* piece of mine,[3] the Chairs of the Harvard and Princeton mathematics departments wrote: "We do not see evidence of an intrinsic deficit of mathematical ability, but we see fewer women in mathematics than we like. "*This is, of course, precisely the point. Why* are there so few women at that level?

(4) The fact that the male mathematical advantage does not manifest itself on tests until adolescence is irrelevant. This is probably a function of the low-level (arithmetical) skill that is tested in preadolescence, but it would not matter if there were *no* difference before adolescence. Effects of even purely physiological causes are often late arrivals in a sequential unfolding. [Preadolescent boys and girls have the same (in)ability to grow mustaches.]

(5) The fact that the sex difference in mathematical performance varies from society to society[4] does not in itself demonstrate even that the difference is not purely a result of physiology (though it is, in fact, likely that some part of the difference is social); the sex difference in height is less in Bali than in the U.S.

(6) The differential socialization of boys and girls can never be a sufficient explanation of why men and women differ in a specific way. To argue the casual sufficiency of socialization is to simply restate the question (*why* do we socialize boys and girls in these ways?) without answering it. To say that men are better at mathematics because we so socialize boys is, if physiology plays a causal role, like saying that men are physically stronger because we socialize children to expect men to be so.

The oft-made assumption that such environmental factors as social values can act as counterpoise to the physiological incorrectly treats the environment as an independent variable. Often the environmental factors are not independent, but get their limits and direction from the physiological and a population's observation of the cognitive and behavioral effects of the physiological.

(7) Thus a physiological causal analysis can accept as true all of the above allegedly refutory facts without being rendered an iota less likely to be correct. The facts are concordant with the analysis.

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4 March 1991

[1] Mary Beth Ruskai, "Are there innate cognitive gender differences?" Am. J. Phys. **59**, 11-14 (1991).

[2] Thus, the oft-made point that within-group differences are greater than between-group differences (while obviously true) is irrelevant. The fact that the differences in height between the shortest woman and the tallest woman or the shortest man and the tallest man (say 4 ft in each case) is greater than the difference between mean female and mean male heights (say, 4½ in.) does not bring into question the primarily physiological causal basis of height nor does it lead us to doubt that virtually a hundred percent of the most desirable basketball players will always be male.

[3] *New York Times*, 5 July 1989

[4] At least at the highest level of mathematical aptitude, it is far from clear that there is much cross-cultural variation (though the information on nonmodern societies is scant). Through 1986, no female had ever qualified for America's team in the "Math Olympiad" and only a tiny number had ever qualified for any nation's team]. I do not have later data available.

PAPER OR PLASTIC?

Upon receiving my most recent copy of the *American Journal of Physics* I was struck by the fact that it was delivered in a PLASTIC shrink wrap-

per. (Apparently this has been the method of choice since at least early 1990, possibly longer.) In the current climate of environmental awareness I feel that the physics community should lead by example. The AAPT should adopt, or if necessary develop, an environmentally more appropriate mailing method.

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8 March 1991

PLASTIC OR PAPER?—A RESPONSE BY THE EDITOR

We use a plastic wrapper for mailing AJP for two main reasons. First, it is somewhat cheaper, and it is a constant concern of mine to keep costs as low as possible. Though AJP subscription prices have of necessity increased from year to year, I am pleased that our increases have been substantially lower than those of most physics journals. Second, for reasons that I do not understand, the United States Postal Service seems to give slower service and do more damage to journals mailed in paper wrappers than to those mailed in plastic. I am pleased to know that subscribers whose copies are late, damaged, or destroyed are not happy subscribers: more so than many physics journals, AJP is actually read! Every damaged or lost copy that must be replaced costs the editorial office or the business office a significant amount of time and money, and also—in the long run—requires the manufacture of more paper.

I emphatically agree that AJP should set a good example. But what does it mean for scientists to set good examples? As those who are familiar with my own energy writing since 1970 are all too well aware (and I include my students who have been asked to read and respond to my assignments!), I insist that the energy problem is a *quantitative* problem. We should, first, choose our battles, giving priority to those decisions with the largest positive or negative impact. Second, we must be as quantitative as possible in evaluating energy and environmental choices. There are few if any such decisions for which the true costs of all the alternatives, externalities included, can be accurately calculated, and the problem of AJP's mailing wrapper is not one of those rare ones that is easy to treat in quantitative detail. At any rate, it is by no means obvious that in this case plastic is bad and paper is good (or at least better). We are trying to keep track of the various possibilities in the hopes of minimizing the damage that production of AJP may do to the world environment, while still providing a journal that survives the mailing process and is produced as economically as possible. Plastic biodegradable wrappers provide one future option, for instance, but as far as I can see at the moment, that does not yet provide a simple and desirable alternative.

While I am at it, I will mention another feature of AJP that has an environmental impact: printing the table of contents on the back cover. We have returned to this traditional practice for obvious reasons. It is our goal not only to print high-quality physics but to get people to read it. It is an obvious convenience to the individual subscriber to have the contents out in plain sight; even more important is the increase in the probability that a library browser will open an issue and read. (Think of the undergraduate "wasting time" in the science library on a Saturday afternoon, as many of us did as undergraduates and have continued to do ever since.) While printing the contents on the back cover, we continue to print it inside as well. Why this duplication? AJP is an archival journal, as well as one that is read when it is new, and most libraries discard the covers when a volume is bound. The direct cost (externalities not included) of this duplication is easy to estimate: about 0.4 cents/copy, a figure that may be converted, if desired, into other units such as trees/year. The *benefit*, however, is not easily quantifiable; my admittedly biased and subjective view is that the benefit of seducing human beings into having eye contact with our printed pages outweighs the cost.

I have, of course, determined what fraction of a tree had to be sacrificed for the printing of this response—in part because (like Fermi and many other physicists) I enjoy making order of magnitude estimates. I omit my result, leaving it as an exercise for the interested reader.

Robert H. Romer, *Editor*
17 March 1991