

letters

proved. First, reduce the time between proposal and contract award, even at the risk that a "second best" contract slips through occasionally. Second, adapt the frequency of progress reports to the type and size of the project and do not insist on significant progress in each period. Third, make research goals as flexible as possible and eliminate milestones altogether.

ALFRED SOMMER
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Sex-linked ability

In my physical science classes one of the major objectives is to help nonscience majors understand the nature of science and how the laws of science are induced. In working toward this objective I stress that there are very few "facts" in science, but rather, that scientists base their inferences on the statistical evidence available at the time.

While agreeing heartily with virtually all of Jewel Plummer Cobb's recommendations for ways to encourage young women to consider careers in science, I was surprised by her statement in August (page 72) which said, "—women scientists and mothers should stress the fact that proficiency in mathematics is not a sex-linked characteristic." Was the word "fact" one of Cobb's own choosing or was PHYSICS TODAY paraphrasing her message at the January APS-AAPT meeting in New York?

If Cobb has sufficient statistical evidence to claim that proficiency in mathematics is not sex-linked as a fact, I would very much appreciate learning about that evidence. Although I don't believe the research I'm familiar with is conclusive, the preponderance of it suggests that mathematics ability may be sex-linked when considered statistically.

Just because our sense of fair play urges us to want to believe that proficiency in mathematics is not sex-linked, we should not claim this ideal as a "fact" or assumption which is never to be questioned. If an evaluative instrument of aptitude for mathematics having generally accepted validity were administered to a large randomly selected sample of young men and women, I have no doubt that certain females would score higher than 95% of the males. Certainly these, and many other mathematically gifted young women, should be encouraged to consider careers in the physical sciences. It would also be useful to carefully scrutinize the mean and deviation scores of the male and female students on an accepted valid instrument administered under tightly controlled experimental conditions. After applying appropriate statistical treatment to the data we may be able to tentatively infer the existence of a relation

with sex in the sample or the lack of such a relationship. Drawing such an inference is different from claiming an idea to be a scientific "fact," however.

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Dean Cobb replies: My statement is made following a study of the literature citing various scientific studies that confirm the absence of clear differences in ability between boys and girls in elementary school. There are national studies to confirm that, up to nine years of age, boys and girls score equally in mathematics tests. If the ability to do math is sex-linked, it would show itself in this age group. There is a paper by Richard Stafford which is most controversial. It has received little acceptance. Most studies indicate that cultural and environmental influences are responsible for any differences noted in older males and females, rather than biological differences that are "intrinsic." As a biologist I am very uncomfortable with the fuzzy data that attributes human intelligence performance in adolescent and post adolescent subjects to genetic causes. The level of clear and sophisticated research is not yet available. If you will read my recent paper "Filters for Women in Science" in the *Annals of the New York Academy of Sciences*, you would be enlightened.

JEWEL PLUMMER COBB
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More on free-electron lasers

In July your news story entitled "Update on free-electron lasers and applications" gives credit to "Henry" Motz for building the "undulator" with reference to my *Journal of Applied Physics* paper of 1951. I was very pleased to see this, but it is unfortunate that my name is not Henry but Hans. At the same time I would like to comment on the explanations given of the device. It is, of course, not wrong to use atomic physics concepts, because quantum phenomena are underlying the purely classical laws of physics—which are sufficient for the theoretical description, except perhaps in the x-ray region. My idea of the amplification process was inspired by R. Kompfner's traveling-wave tube, where the helix slows down the wave so that it can be in near synchronism with the electron beam. It occurred to me that near synchronism could also be achieved¹ by making the electrons undergo a periodically deflected path. A recent analysis by Norman Kroll² elaborates my theory in an admirable way. In a recent paper³ I pointed out that there are essential differences between the operation of a laser

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