6. L. Fox, L. Brody, D. Tobin, *The Study of Social Processes That Inhibit or Enhance the Development of Competence and Interest in Mathematics Among Highly Able Young Women* (National Institute of Education, Washington, D.C., 1982).
7. D. A. Williams and P. King, *Newsweek*, 15 December 1980, p. 73; J. Durden-Smith and D. DeSimone, *Reader's Digest*, November 1982, p. 263.
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Benbow and Stanley present some persuasive data that important sex differences in mathematics achievement are evident by grade seven, especially when scores exceeding 700 on the SAT-M are used as the criterion. They also argue that these and later sex-related performance differences cannot be accounted for by differences in enrollments in math courses or school grades in math. The latter finding agrees with our own data (*1*) and a recomputation of data by Fennema and Sherman (*2*) showing that less than 2 percent of variation in enrollments is accounted for by sex as a variable. In our paper (*1*), we offer an alternative hypothesis and some data to support it.

Our hypothesis derives from cognitive learning theory (*3*) and empirical studies that indicate females more than males are socialized into rote mode learning patterns, which predominate in school classrooms, and that such learning patterns become progressively more debilitating in course work or careers where complex problem-solving or creativity is required. Of course, many males also succumb to school pressures toward rote mode learning, and hence the potential talent pool of persons skilled at complex problem-solving is reduced for both sexes.

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Beckwith and Woodruff imply that Julian Stanley and I have been remiss in failing to suggest new areas in which to search for reasons for the sex differences in mathematical reasoning ability in our data (*1, 2*). In fact, their first "new" question (What is the significance of scores on the SAT-M?) is a central question the Study of Mathematically Precocious Youth (SMPY) was established to investigate. For 10 years SMPY has studied the predictive validity of the SAT-M for our population. Moreover, SMPY is a long-term (approximately 50 years) study designed to determine to what extent high SAT-M scores predict adult achievement. In seven books and numerous articles we have shown that scores on SAT-M do relate closely to success in high-level, fast-paced mathematics and science courses, to educational acceleration, and (especially) to the choosing of careers requiring excellent quantitative ability (*3*). We must wait, however, another few decades to study their long-term predictive validity for vocational achievement. Our earliest SMPY'ers are only in their mid-20's. It seems, therefore, that we have not only been asking the first question posed by Beckwith and Woodruff, but we found the sex differences by asking it.

Beckwith and Woodruff state that we have reported that girls in our study "did better than the boys in math courses and in an advanced placement math test while in high school." The second part of this statement is incorrect. We showed (*4*) that the boys scored significantly *better* on the College Board mathematics achievement tests. Moreover, even though a larger percentage of the boys than the girls took the Advanced Placement calculus tests, boys scored *better* in five to six comparisons and girls in one. It is difficult to image how such numbers indicate that girls do better.

Their statement about better grades is true. It has been, however, attributed to the better conduct of girls in school (*5*). Moreover, course grades are hardly a measure of mathematical reasoning ability, the ability that we study.

Beckwith and Woodruff quote us out of context as saying that "the boys in the study 'enjoyed mathematics more than girls ($P = 0.001$)' " (*6*). The remainder of the quotation is crucial: "As evidenced from the effect size (small, $d = .33$), the difference was not large. The four r's between liking of mathematics and SAT scores were also small, $-.04$ to .17 (Table 3). Thus, at this stage, ability and sex do not relate to degree of liking for mathematics" (*6*). In addition, we simply did *not* report that "nearly twice as many boys as girls . . . had participated in special math programs."

We did report that "boys tended to take math courses at an earlier time than girls in high school." This, however, occurred *after* the students had been tested, and so could not possibly have influenced the SAT-M scores we measured.

We have never said that our boys and girls had identical learning experiences. Nevertheless, it is difficult to reconcile how differences in learning experiences in the classroom can affect mathematical reasoning ability but not computational ability, where girls are superior, nor the ability to apply learned concepts, where there are no differences.

Beckwith and Woodruff also misrepresent the conclusion of Fox *et al.* (*7*) that "the backgrounds of the boys and girls differ, including out-of-class math experience." In fact Fox *et al.* conclude that "On the basis of this study of five samples of very mathematically able girls and boys, there appear to be only a few differences in the attitudes and experiences of these students and the attitudes or behaviors of their parents or teachers that suggest some of the social processes that may influence the development of interest in pursuing scientific careers or accelerating the learning of mathematics at home or school" (*7*, p. 168).

Finally, Beckwith and Woodruff raise the valid issue of the hazards of inaccurate or sensational publicity. Although the media have used the term "math gene," SMPY has always carefully avoided the words "gene" or "genetic." Our view is still as follows. It "seems likely that putting one's faith in boy-versus-girl socialization processes as the *only* permissible explanation of the sex difference in mathematic[al reasoning ability] is *premature*" (*1*) [emphasis added].

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Erratum: A line was inadvertantly omitted from the last sentence of George S. Mumford's letter of 20 January (p. 238). It should have read, "If, at an early stage, we could foster in this manner a feeling among our graduates of their indebtedness to the general public for directly or indirectly supporting their research and the right of that public to know the results, it might become traditional for them to proceed in such a way throughout a career."