

**THIS WEEK**

Most distant galaxies yet found	148
Spotlight on interferon	148
Viral gene copycats	149
Mt. St. Helens continues	149
Science talent search winners	150
Genetically engineered animal vaccine	150
Clean air studies spark debate	151
Direct pay for psychologists	151
Student group plans satellite	151

**RESEARCH NOTES**

Chemistry	152
Environment	152
Behavior	153
Biomedicine	153

**ARTICLES**

Autism: Penetrating the wall	154
Jarvik-7 a heartbeat away	157

**DEPARTMENTS**

Letters	147
Off the Beat	156

**COVER:** William C. DeVries compares a model of the human heart (right) with the type of artificial heart he expects to implant in a human patient—perhaps as early as this spring. The artificial heart, designed by Robert K. Jarvik, has been under development for more than 20 years at the University of Utah Medical Center in Salt Lake City. See story p. 157. (Photo: Univ. of Utah Med. Ctr.)

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**Sex differences in math reasoning**

The three responders on February 14 to SN's "lead story of the week" (SN: 12/13/80, p. 372, "Mathematical Sex Differences: It's in the Numbers") do women no favor by erecting various straw men to explain away the basic finding by Benbow and Stanley that highly motivated 12-year-old girls *matched* with boys on an in-grade mathematics test tend to score considerably less well than these boys on a difficult test of mathematical reasoning ability (SCIENCE, Vol. 210, 12 Dec. 1980, p. 1262, "Sex Differences in Mathematical Ability: Fact or Artifact?"). The heart of our article, a large table showing those differences in detail, reveals percentage ratios of high-scoring 7th grade boys to girls ranging from 3.2:0.9 to 7.8:0. This is—quite unfortunately, we agree with our critics—the firm "what" of the situation, not to be negated by invoking seemingly plausible "whys" to explain away the differences.

Our article concluded as follows: "We recognize, however, that our data are consistent with numerous alternative hypotheses. Nonetheless, the hypothesis of differential course-taking was not supported. It also seems likely that putting one's faith in boy-versus-girl socialization processes as the only permissible explanation of the sex difference in mathematics is premature." The key words here are "faith," "only" and "premature."

Contrary to Grossblatt's claim that we draw "a false conclusion about genetic differences" and thereby "commit a serious logical error," the word "genetic" does not even appear in our article (the word we did use, "endogenous," has a much broader meaning). We do cite a number of relevant studies and mention as many of their findings as space in the two-page report permits. From ten years of experience with 20,000 able boys and girls involved by us and others in many mathematics activities, the Johns Hopkins Study of Mathematically Precocious Youth (SMPY) has produced seven books and more than 100 articles that examine various facets of achievement in mathematics, including sex differences. Our sentences quoted above and the article as a whole do not go beyond those data.

Neither Fergus nor Blethen seems to have read the SCIENCE article itself. The former accused us of "inventing" the differential course-taking hypothesis, "an argument that was never made," even though we cited "the Fennema and Sherman differential course-taking hypothesis." Worse, though, Fergus listed the usual armchair assumptions "such as girls' expectation that higher mathematics [among 12-year-olds!] would not be personally useful to them, lack of confidence in their ability to learn math, and lack of encouragement by parents and teachers." These apply little, if at all, to the eager, able girls who entered our talent searches seeking high scores on a difficult mathematical reasoning test and educational facilitation in that subject. Also, our results "suggest that... the influences of societal expectations and attitudes... are more significant for achievement [and, we might add here, interest] in mathematics than for mathematical" reasoning ability.

None of our critics thus far has documented his or her assertions about the existence and

extent of environmental pressures on able girls (like those in our studies) to score poorly on mathematical reasoning tests, nor about the occurrence or non-occurrence of the logical outcomes of those presumed pressures. Without even a firm environmental data base, casual observers and anecdotalists move us not a whit closer to establishing the causal couplings they assume exist. A lot of "sweep it under the rug" sexual politics is being practiced, in letters to editors and elsewhere. Understanding how to help women achieve better in mathematics and related fields is the loser.

Camilla Persson Benbow  
Julian C. Stanley  
Baltimore, Md.

The extremely adverse critical reviews given on the report of sex differences in mathematical ability are unwarranted. The data collected by Benbow and Stanley do not prove but do strongly suggest that genes may indeed be a factor in bringing about sexual differences in mathematical ability and that further studies are merited.

Competent comparisons of IQs of males versus females show no significant difference between average IQs of males versus females. But males are significantly more variable than females, having higher proportions of mentally retarded and geniuses than do females. Recent investigations suggest that such variations may result from sex-linked genes. Current studies (Am. J. Hum. Gen. 11/80, p. 73-4A) show significant associations between abnormal X chromosomes and two types of mental retardation, indicating sex-linkage.

Mathematical ability is only one of the many components of intelligence. More knowledge concerning the role of genes in determining the basis of intelligence is urgently needed.

David C. Rife  
Clewiston, Fla.

**Food vs. oil**

"The food supply: Don't be fuelish" (SN: 1/10/81, p. 21) impressed me as an informative and generally excellent article, but I was disturbed by the omission of consideration of the ratio of alcohol energy derived from agricultural crops to the oil-derived energy used to produce the crops.

Data available to me indicate that for every gallon of alcohol produced, approximately two gallons of gasoline will have been burned in planting, fertilizing, harvesting, transporting, and treating the crops from which the alcohol is obtained. This, combined with the consideration that alcohol yields less energy per gallon than gasoline, introduces a very significant additional parameter that may render altogether academic the question of fuel versus food usage of various agricultural crops.

I fully realize that the crops may return as silage (feed for livestock) after alcohol extraction, thus improving the economics, but I think that the public should be made fully aware that there is not any net energy gain whatever in burning two gallons of gasoline to get one gallon of alcohol. Government support of such an industry beyond our need for its silage by-product would simply accelerate depletion of oil resources, without which we could grow no more crops for alcohol production or for food.

Craig Bond Hatfield  
Toledo, Ohio

Correction: The hydrocarbon dodecahedron (SN: 2/7/81, p. 85) should have been described as a 12-sided, 20-cornered structure.