Mathematical Sex Differences: It's in the Numbers

Neither men nor women like to be told that they are in any way intellectually inferior to members of the opposite sex, but that's what intelligence and mental ability tests have been indicating for years. Males have been found to excel in numerical reasoning and spatial judgment, females in verbal fluency and rote memory. The data showing these sex differences are so extensive that they cannot be denied. What has been denied is that there is an innate intellectual difference between the sexes. Social, cultural and environmental influences have been used to explain observed differences in mental functioning, and a great deal of research exists that supports this hypothesis. Now comes a major study from Johns Hopkins University in Baltimore suggesting that the environmental argument is not sufficient to explain observed sex differences in mathematical ability. "We favor the hypothesis that sex differences ... result from superior male mathematical ability, which may in turn be related to greater male ability in spatial tasks," say Camilla Persson Benbow and Julian C. Stanley in the Dec. 12 SCIENCE.

Differences between males and females in mathematical reasoning ability usually begin to show up on tests taken in the 9th, 10th and 11th grades, but by this time boys and girls will usually have been exposed to different educational experiences that might account for differences in achievement. Benbow and Stanley sidestepped this argument by studying the test results of 9,927 7th and 8th graders, and they say their findings don't support the differential course-taking hypothesis because until 8th grade all students have received essentially identical formal instruction in mathematics. (Their study does not, however, account for the many other social influences present since birth.)

The data for the Johns Hopkins study were collected over the past eight years as part of Stanley's Study of Mathematically Precocious Youth. During six talent searches students took both the mathematics and verbal parts of the Scholastic Aptitude Test. Boys and girls performed about equally well on the verbal tests, but "a large sex difference in mathematical ability in favor of boys was observed in every talent search," say the researchers. And this difference was observed "before girls and boys started to differ significantly in the number and types of mathematics courses taken."

In follow-up studies the sex differences in favor of boys were sustained and even found to increase. The 40-point mean difference in favor of boys at the time of the talent search increased to a 50-point mean difference by the time of high school graduation. This increase, the researchers admit, "is consistent with the hypothesis that differential course-taking can affect mathematical ability." But they also say it is possible that "less well-developed mathematical reasoning ability contributes to girls' taking fewer mathematics courses and achieving less than boys."

The Johns Hopkins study and others do suggest that socialization processes are not enough to explain the observed sex differences, but it may be necessary to look even earlier than 7th grade to completely rule out such influences. Grayson H. Wheatley of Purdue University in Lafayette, Ind., for instance, has reported sex differences in the way the brains of males and females deal with certain mental tasks (SN: 6/9/79, p. 375). He tested high school students and found that "boys appropriately used the left hemisphere for analytical/linguistic tasks and the right hemisphere for spatial tasks." Girls, on the other hand, "tended to use their left hemispheres in processing all the tasks"—suggesting that by the time boys reach high school their brains are more functionally balanced than are those of girls. This could be a true sex difference, but Wheatley says part of the difference "may be that boys are encouraged from an early age to do activities which develop spatial performance, such as playing with blocks or toys requiring large muscle activities." The same argument will be used against the Johns Hopkins study, and the researchers admit that "our data are consistent with numerous hypotheses. Nonetheless," they say, "the hypothesis of differential course-taking was not supported."

So the debate over the causes of intellectual differences between the sexes will continue, but even if a certain amount of the difference is eventually proved to be the result of hormonal or chromosomal influences, there is evidence that the differences can be overcome. Wheatley, for instance, is finding that a college math course that emphasizes spatial abilities (visualizing objects moving in space, constructing three-dimensional models, working with transformations and reflections) can result in significant increases in spatial abilities. □

Biotechnology business booming

Business aspects of biotechnology have had a burst of activity that includes a patent, proposal of another stock offering and a new British corporation.

The first U.S. patent in the area of gene-splicing research was recently granted by the U.S. Patent Office. It covers a method for recombining and reproducing pieces of genetic material. Developers of the process are Stanley N. Cohen of Stanford University and Herbert W. Boyer of the University of California at San Francisco who first described the technique in a paper published in 1973. The universities applied for the patent in 1974. A second part of the patent application covers products resulting from the gene-splicing technique. That portion is still pending, but it is expected to be issued, in accordance with the recent U.S. Supreme Court decision permitting patenting of living organisms (SN: 6/21/80, p. 387).

The universities plan to grant licenses on a non-exclusive basis for "reasonable" royalties to companies using the technique and will require that companies follow the safety provisions described in the National Institutes of Health guidelines. Cohen and Boyer have waived their rights to personal royalties, so all royalties will go to the universities.

Genentech, the first genetic engineering company to offer public stock, created quite a stir on Wall Street (SN: 10/25/80, p. 261). Now a second biotechnology firm, Cetus Corp. of Berkeley, Calif., has announced that it will follow suit and register an initial offering of common stock with the Securities and Exchange Commission. Currently, 39 percent of Cetus is owned by its founders, employees and some private investors and the rest by Standard Oil of California, Standard Oil Co. (Ohio) and National Distillers and Chemicals, Inc.

On the British scene, formation of Celltech, the first company dealing predominantly in biotechnology, was completed last month. Its backing is quite different from that of its U.S. counterparts. The largest stockholder in Celltech is the National Enterprise Board, a public corporation supported with public funds. It holds 44 percent of the Celltech shares, and the rest are shared among Prudential Assurance Co., Midland Bank, British and Commonwealth Shipping and TDC, a venture capital investment trust. The board of the company includes the secretary of the Medical Research Council (MRC) and the foreign secretary of The Royal Society. Sydney Brenner, director of the MRC Laboratory for Molecular Biology, has been involved since the beginning in Celltech's planning and will be on the company's advisory board. Celltech has reached agreements, not yet made public, with the MRC regarding access to research of its laboratories and with the National Research Development Corp. regarding patent rights. □