The 'math gap' : Puzzling sex differences

For some time, scientists have observed that boys score much higher than girls on mathematics tests. Based on studies of more than 100,000 intellectually gifted 12- and 13-year-olds, for example, there are 13 boys for every girl who scores at least 700 out of 800 on the mathematics section of the Scholastic Aptitude Test (SAT) (SN: 4/27/85, p.263). What researchers have not been able to calculate, however, is how the "math gap" is affected by parental attitudes and cultural values.

Now, a report in the November DEVELOPMENTAL PSYCHOLOGY says that several plausible environmental influences on mathematics achievement do *not* appear to sway the SAT scores of gifted and above-average junior-high students. The first possibility examined by Camilla Benbow of Iowa State University in Ames and Cindy L. Raymond of Yale University was that youngsters consider mathematically related fields to be masculine domains, so girls are less motivated in those areas. Second, since no sex differences in verbal ability have been found, the psychologists looked at whether parents encouraged mathematically talented students more than verbally talented students and whether males received more encouragement in quantitative areas than females.

"It is improbable that these factors influence the sex differences in math achievement among intellectually talented children," says Benbow. The data, she adds, do not apply to normal-range achievers in mathematics.

The 200 extremely talented students in the study, whose average age was nearly 14 years old, had taken the SAT about one year earlier and scored at least 700 on the mathematics section or at least 630 on the verbal section. Youngsters who surpassed both the mathematics and verbal cutoffs were excluded from the project.

A slightly older comparison group of 111 students had taken the SAT about two years prior to the study and achieved approximately chance scores (combined mathematics and verbal scores no greater than 540). They had, however, obtained extremely high scores on an ingrade achievement test. The SAT is designed to be taken by high school seniors.

On questionnaires, neither the gifted nor the comparison group reported significant gender differences in parental encouragement. Intellectually talented males did not perceive greater mathematical encouragement than did their female counterparts. Fathers were not more involved with mathematically talented children than with verbally talented ones, and the reverse was not reported for mothers. Fathers were reported to be somewhat more math-oriented and mothers more verbal-oriented, but these tendencies were not strong.

Furthermore, 59 percent of the gifted students and nearly three-quarters of the comparison group did not label mathematically related areas as masculine and verbal areas as feminine. The tendency to assign one sex preeminence in an academic area was not related either to the pattern of parental encouragement or to SAT scores.

These two factors — parental attitudes and the perception of mathematics as masculine — join a growing list of environmental variables that have failed to account for sex differences in mathematics achievement, notes Benbow. She has, for instance, uncovered no sex differences in childhood toy preferences of the same students. This undermines the contention that boys prefer playthings, such as construction toys and building blocks, that promote mathematical reasoning abilities. Researchers have also observed no sex differences among gifted students in assessments of the future career value of mathematics and mathematics course-taking in high school.

Despite these results, Benbow says, "I certainly believe the environment is involved *somehow* in these well-established sex differences." Future research, she says, should examine whether girls have a wider variety of interests than boys and thus have less time to pursue mathematics.

On the other hand, says Benbow, biological traits such as left-handedness and susceptibility to allergies are associated with mathematical and verbal precocity. She suggests these traits may be fostered in part by overexposure of a fetus to the hormone testosterone, which some scientists say enhances the brain's right-hemisphere development and improves communication between hemispheres; this, in turn, may aid in the comprehension of mathematics and relationships between difficult words.

"No one knows when critical math and verbal abilities first develop," says Benbow, "but environment and biology can't really be separated." — *B. Bower*

How plants say 'no' to fungus

Although you never hear them complaining, plants have a tough life. If bacteria, viruses, worms, locusts, other plants, wind, sun or air pollutants aren't harassing them, fungus might very well be bringing plants to a brown, wilted end. But despite their inability to run away from their oppressors, plants make defensive stands in ways that are only partially understood.

Now, a quartet of Swiss scientists reports direct evidence that some plants defend themselves against fungus by producing an enzyme called chitinase that potently inhibits fungal growth. Not only is this the first time a biological function has been associated with the enzyme, according to the scientists, but chitinase also could have agricultural applications.

Chitin — a tough biological polymer — is the major constituent of the exoskeletons of lobsters, crabs and many insects. It is also one of the major building materials of the fungal cell wall. Several research groups have observed that when chitinase and certain other enzymes are present, tiny chunks of fungal cell walls break off. But this is only indirect evidence and does not pinpoint chitinase as the fungus fighter, says Angela Schlumbaum, who authored the report with Felix Mauch, Urs Vögeli and Thomas Boller, all from the Botanical Institute of the University of Basel. The report appears in the Nov. 27 NATURE.

To catch chitinase red-handed, the scientists purified it from bean plants and tested its effect on the fungus *Trichoderma viride*, which they had cultured in petri dishes. They found that chitinase inhibits fungal growth in proportion to the amount of the enzyme present. The Swiss scientists also found that if they denatured the chitinase by boiling it, or if they added antibodies that bind to it, antifungal activity was blocked.

In addition, chitinase from crude protein extracts of bean leaves showed antifungal activity that increased if the leaves were first treated with ethylene, which is known to induce plants to manufacture chitinase. If the researchers added antibodies against chitinase to the crude protein extracts, antifungal activity was blocked.

The newly reported work "is the first time that anyone has demonstrated that chitinase has the possibility to inhibit the fungus," Schlumbaum told SCIENCE NEWS. By itself, chitinase inhibits *Trichoderma viride*, she adds, but to inhibit many other fungi, other natural enzymes such as β-1,3-glucanase must be present.

Plant pathologist Richard M. Bostock of the University of California at Davis says the Swiss findings describe for the first time a possible defensive function for the enzyme. Bostock told SCIENCE NEWS that further understanding of how chitinase activity is controlled by the plant genes could enable scientists to manipulate it either by using techniques of genetic engineering or by learning how to turn the gene on or off with well-designed molecules.

— *I. Amato*