Does tin fall prey to methylation?

Microorganisms can be a bad influence on metals: By inadvertently attaching methyl (CH_3) groups to metallic compounds, they can convert those compounds that normally are water soluble and not eager to cross biological membranes into relatively insoluble ones that can accumulate in the food chain. This villainous methylation by microbes has been shown to occur on mercury and lead; now some researchers believe the process also occurs on tin.

Microorganisms from Chesapeake Bay sediments were shown to attach methyl groups to certain tin compounds, report Jay C. Means and colleagues of the University of Maryland at Solomons in the March 19 SCIENCE. In flasks and tubes of sediment microflora, a chlorine-containing tin compound was converted to tin compounds with two and three methyl groups. Methylated tin was not observed in controls that had been sterilized, suggesting the transformation to "methyltin" was the result of biological activity. Such transformations are of current interest because of the extensive use of man-made tin compounds.

Tin, a ductile metal, is used as a protective coating for steel and in solder, bearing metals and the like. Moreover, more than 25,000 metric tons of organic (carbon and hydrogen-containing) tin compounds are incorporated annually into insecticides, herbicides, fungicides and antifouling paints — coatings formulated especially for use on hulls and bottoms of ships to protect them from attack by barnacles and other marine organisms.

The fate of these various tin compounds when they enter the environment is a subject of growing interest. If microbial methylation proves to be their destiny, then "fairly significant toxicological problems could arise in given regions," Means says. "I'm not one who likes to extrapolate too far from experimental data," he says, "but I believe it's logical to say that microbial methylation is occurring in the real world and, depending upon the region in question, that it could be a problem."

National Bureau of Standards researcher Frederick E. Brinckman, on the other hand, believes it is too early to extrapolate from experimental data. Besides, says Brinckman — who, along with NBS colleagues, reported in the February ENVIRONMENTAL SCIENCE & TECHNOLOGY the discovery of methyltin compounds in the Chesapeake Bay — Means and colleagues have yet to prove that their tin methylation was purely microbial. The microbes could have transformed the tin compound into an intermediate that in turn was methylated by nonbiological events. The distinction in modes of methylation is an important one to make, says Brinckman, "if you're trying to backtrack to figure out how to control it." In addition, if nonbiologic events such as chance interactions with sediment chemicals figured in, then methylation of tin would not be expected to be as extensive as if it occurred purely by microbes. —*L. Garmon*

Math ability: Proof of sexual parity?

Research results showing sexual equality in an advanced form of geometrical problem solving have once again fueled the perennial debate over sex-differences in mathematical ability. According to the University of Chicago researchers who conducted the study, the new findings contradict and explain the 1980 data of two Johns Hopkins researchers which indicated male superiority among the most talented math students.

Zalman Usiskin and Sharon Senk will report this week at a meeting of the American Educational Research Association that a test of 1,366 high school students revealed no significant sex-differences in the ability to perform geometrical proofs. Such a specialized mathematical task is a powerful indicator of the ability to learn math, according to Usiskin, because students almost never learn geometrical proofs on their own. As a result, he said in an interview, testing proof writing ability minimizes the effects of experience — parental encouragement, for example — on math performance. In addition, Usiskin noted, geometrical proofs test both abstract reasoning and spatial ability, two cognitive areas in which girls are supposed to be weaker than boys.

Interestingly, Usiskin added, boys did outscore girls on overall achievement in geometry — both before studying geometry and after. These findings support the results of Johns Hopkins researchers Julian C. Stanley and Camilla Persson Benbow, which had indicated that the most clever seventh and eighth grade boys consistently outscored their female counterparts. But while Stanley and Benbow have argued that early aptitude test scores cast doubt on any environmental hypothesis for male superiority, Usiskin believes the opposite — that such test scores are most likely to reflect differential exposure to math outside the classroom and that highly talented students are most likely to pick up math on their own. Stanley dismisses Usiskin's argument. "Anybody can sit in a chair and spin webs of speculation," he says, "but you need evidence. He's not dealing with why." Most data, he says — including two years' of subsequent data at Johns Hopkins — clearly indicate male superiority in mathematical reasoning, while Usiskin's data merely support a well-known fact — that girls do well in school. —*W. Herbert*

Laetrile and birth defects

Laetrile hasn't been getting much support from biomedical research lately. A National Cancer Institute clinical trial found it ineffective in combatting cancer (SN: 5/9/81, p. 293). And now it appears capable of causing birth defects, at least in hamsters, Calvin C. Willhite of the U.S. Department of Agriculture Western Regional Research Center in Berkeley, Calif., reports in the March 19 SCIENCE.

Cyanide given to pregnant hamsters is known to cause birth defects. Because a principal breakdown product of orally consumed (but not of injectable) Laetrile is cyanide, Willhite attempted to learn whether orally consumed Laetrile might produce birth defects in hamsters. He gave oral doses of amygdalin (the primary constituent of Laetrile), ranging from 200 to 300 mg/kg of body weight, to 46 pregnant hamsters; injectable amygdalin in a 275 mg/kg dose to 11 pregnant hamsters; oral sodium chloride (a placebo) to five pregnant hamsters; injectable sodium chloride (another placebo) to six pregnant hamsters; an oral 177 mg/kg dose of prunasin (an intermediate breakdown product of orally consumed amygdalin) to eight pregnant hamsters; and an oral 275 mg/kg dose of amygdalin plus sodium thiosulfate (a compound known to reverse the birth defect effects of cyanide) to 12 pregnant hamsters. All animals got their treatments on day eight of gestation, which is comparable to days 20-25 in human pregnancies, and a time when fetuses are especially vulnerable to chemically induced birth defects.

Litters from mothers which had gotten placebos during pregnancy had no birth defects, nor did those from mothers which had gotten injectable amygdalin. In contrast, there were malformations in 15 percent of the litters from mothers which had gotten prunasin, in 24 percent of the litters from mothers which had gotten 250 mg/kg oral amygdalin, in 32 percent of the litters from mothers which had received 275 mg/kg oral amygdalin and in 38 percent of the litters from mothers which had gotten 300 mg/kg oral amygdalin. Yet only two percent of the litters from mothers which had received oral amygdalin counteracted by sodium thiosulfate had defects. Thus orally consumed Laetrile appears capable of causing birth defects in hamsters essentially via its breakdown product, cyanide.

But does orally consumed Laetrile produce similar malformations in human fetuses? One reason to think so, Willhite told SCIENCE NEWS, is that it results in high levels of cyanide in the blood of cancer patients as it does in hamsters. Yet a reason to think it might not, he concedes, is that the doses that caused defects in hamsters were some 10 times higher than those used by patients. —*J. A. Treichel*