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Methyl Mercury

During this century, in the United States, about 75 million kilograms of mercury have been consumed; little information is available on its final disposition or on the concentration of the element at specific points in the environment. Recently, it has become clear that compounds of mercury present a substantial hazard. Of particular significance is methyl mercury, a highly toxic substance that causes neurological damage, produces chromosomal aberrations, and has teratogenic effects. It is mainly in this form that mercury is found in food fishes. Recent studies have elucidated some of the steps in the accumulation.*

Industrial wastes containing inorganic mercury or phenyl mercury find their way into bottom muds of lakes. There they are converted by anaerobes into CH_3Hg^+ or $(CH_3)_2Hg$. The latter compound is volatile, and it escapes into the water column from the sediment. Though quite stable in alkaline solutions, $(CH_3)_2Hg$ is converted to CH_3Hg^+ at low *p*H. This ion is soluble in water, and it is concentrated by living things, usually appearing in the body lipids. In part, the concentration may come by way of the food chain, but apparently fishes may also accumulate the toxic ion directly. The concentration factor from water to pike is of the order of 3000 or more.

Substantial mercury pollution in the Great Lakes became apparent in March of this year. Mercury concentrations as high as 5 parts per million were reported in some pickerel shipped from Canada. Typical concentrations in fish taken from Lake Erie were 1 part per million or less. Further investigations have confirmed the existence of a major environmental problem traceable to the dumping of large amounts of mercury-containing liquid wastes. This discovery comes as a surprise to most scientists and apparently to federal authorities. However, there was ample reason for looking for such a phenomenon. Episodes in Sweden† and Japan had pointed to dangers arising when large quantities of mercury are discharged into the environment. In Sweden the use of methyl mercury in a seed dressing had led to a drastic decrease in wild bird populations. Near Minamata, Japan, between 1953 and 1960, 111 persons were reported to have been killed or to have suffered serious neurological damage as a result of eating fish and shellfish caught in mercury-contaminated areas. Among the 111 were 19 congenitally defective babies born of mothers who had eaten the fish and shellfish. Later, at Niigata, Japan, 26 cases of methyl mercury poisoning were noted. The affected persons and their families ate fish with a frequency of 0.5 time to 3 times a day; the fish contained mercury at concentrations of about 5 to 20 parts per million.

Physiological and cytological studies have revealed some of the behavior of methyl mercury. It tends to be associated with red blood cells and nervous tissue, and it easily passes the placental barrier, becoming moderately concentrated in the fetus. It can cause chromosomal disorders. Fruit flies consuming food containing methyl mercury at a concentration of 0.25 part per million had offspring carrying one extra chromosome.

It seems unlikely that anything approaching the Japanese observations will be seen in the region of the Great Lakes. There the concentrations of methyl mercury in fish are lower and fish are a less important part of the diet. Nevertheless, we have a substantial and long-enduring problem; even if fresh pollution were stopped, it would be many years before natural processes could cleanse the lakes.

This episode has not led to demonstrable tragedy, but it should remind us how much we risk when we convert our rivers to sewers and our lakes to cesspools.—PHILIP H. ABELSON

* S. Jensen and A. Jernelöv, "Biological methylation of mercury in aquatic organisms," *Nature* **223**, 753 (1969). † Report of an International Committee, "Maximum allowable concentrations of mercury compounds," *Arch. Environ. Health* **19**, 891 (1969).