

## ZEROING IN ON POLLUTION, CRIMINALITY CONNECTION

When different scientists using different approaches reach similar conclusions, it's called "converging evidence"-and it excites researchers, because it's the best confirmation of a scientific hypothesis. According to Roger Masters and colleagues, such a body of converging evidence implicates toxic heavy metals as culprits in America's epidemic of violent crime.

Masters and colleagues theorize that "environmental pollution interacts with poverty, poor diet, alcohol or drug use, and social stress to put some individuals at risk for sub-clinical toxicity, leading to a loss of impulse control and increased violent crime." Scientific support for the heavy metal/crime link, the researchers say, comes from five different types of research:

### **1. CORRELATION: are violent criminals more likely to have high levels of toxic metals than non-criminals?**

Masters and colleagues say seven studies of prison inmates all found that hair levels of either manganese or lead and cadmium were significantly higher in violent offenders than in non-violent offenders or controls. "Equally interesting," the researchers say, "is the fact that lithium, which has been found to detoxify manganese, was abnormally low in two of the seven samples."

Masters et al. add that research strongly links sub-clinical lead poisoning to learning disabilities and attention deficit disorder-both risk factors for deviant behavior (See related articles, [Crime Times, Vol. 1, No. 3, Page 4](#); [Vol. 2, No. 2, Page 1](#); [Vol. 2, No. 4, Page 7](#)). Furthermore, they say, "extreme concentrations of manganese have also been associated with violence in environments with mining operations or industrial exposure."

### **2. PREDICTION: are children with high toxin levels at increased risk for criminal behavior in later life?**

In two studies of lead, Masters et al. note, "lead uptake at age 7 was significantly predictive of juvenile delinquency or increased aggression in teenage years and early adulthood."

The largest and longest prospective study of toxins' effects on behavior, the researchers say, was a longitudinal study of 1,000 black Philadelphia residents, studied from birth to age 22. This study, Masters et al. say, found that "both lead intoxication and anemia at age 7 were significant predictors of the number of juvenile offenses, seriousness of juvenile offenses and number of adult offenses for males."

### **3. FUNCTION: could toxins' biological effects lead to criminal behavior?**

Masters et al. say studies show that toxins can affect both the structure of the developing brain, and the function of neurotransmitters-the brain's "messenger" chemicals. "Of particular importance," they say, "may be synergistic interactions between elements whose toxicity is greatly multiplied when they are combined." Among the many proven neurotoxic effects of heavy metals:

- Excess lead in the brain damages cells called glia, which help detoxify harmful substances and are critical in behavioral inhibition.
- Excess copper in the neonatal brain is associated with abnormal development of the hippocampus, a brain structure that plays a critical role in learning.
- Excess manganese reduces brain levels of the neurotransmitters serotonin and dopamine, while increasing serotonin concentrations elsewhere in the body. Both human and animal studies link low brain serotonin to impulsive violence, and altered dopamine levels are implicated in a wide range of aberrant behavior.

### **4. TRANSMISSION: are criminals likely to be exposed to toxins?**

Despite the bans on leaded gasoline and paint, studies reveal high levels of lead in the soil

along heavily traveled urban automobile corridors. Additional sources of lead and other toxic heavy metals include industrial plants, aging public water systems, water pipes within homes, and leaded paint in older homes.

Children are particularly susceptible to these toxins, Masters et al. say, because they absorb up to 50% of the lead they ingest (as compared to 8% for adults), and because their brains are still developing. Infant formulas also affect manganese levels: laboratory studies show that cellular uptake of manganese from cow's-milk formula is five times greater than from mother's milk, and the uptake from soy formula is 20 times greater. Thus, the researchers say, the practice of bottle-feeding—much more popular among poor, uneducated mothers than among wealthier mothers—"greatly increases the infant's exposure to toxicity."

Research also shows that nutritional deficiencies exacerbate the effects of toxins. "For example," Masters et al. note, "laboratory animals whose diet included excess manganese did not absorb it when calcium levels were normal, whereas manganese uptake became significant when their diet was deficient in calcium." Studies show that black teenage males consume only about two-thirds as much calcium as whites, and that calcium intakes of Hispanics, and of black women of child-bearing age, also are far lower than the white average. "Given the increased uptake of neurotoxic metals associated with calcium deficiencies in laboratory studies," the researchers say, "calcium deficits among the poor may have particularly deleterious effects during infant development and childhood."

The effects of toxins, the researchers add, are magnified by alcohol. "As a result," the researchers say, "the combination of alcohol consumption and poor diets, often found in marginal young males, puts them at particular risk."

##### **5. ECOLOGY: do areas with high pollution levels have more crime?**

If heavy metals and violent crime are associated, Masters et al. say, "ecological measures of environmental pollution, controlling for other variables, should correlate with higher rates of violent crime." And indeed, Masters' research shows a strong relationship.

Masters et al. created a dataset of all U.S. counties, integrating the U.S. Environmental Protection Agency's Toxic Release Inventory for lead and manganese, crime reports from the FBI, alcoholism statistics from the federal government, and socioeconomic and demographic data from the Census Bureau. "Controlling for such conventional factors as income, population density, and ethnic composition," the researchers say, "environmental pollution had an independent effect on rates of violent crime."

Furthermore, the researchers say, counties with industrial lead pollution, industrial manganese releases, and higher than average rates of alcoholism "have rates of violent crime over three times that of the national average."

The converging evidence linking heavy metal pollution to criminal behavior, Masters et al. say, may point crime prevention efforts in new and more productive directions. Among the approaches they suggest:

- Give parents nutrition training, and encourage breast feeding.
- Encourage vitamin supplementation for children, and particularly for those at serious risk of deficiency.
- Ensure that preschool programs provide good diets in addition to good educational programs.
- Identify the precise biochemical imbalances from which criminal offenders suffer, and treat these imbalances as part of their rehabilitation program.
- Place greater emphasis on reducing existing pollution—and preventing future threats to the environment. "One issue of immediate importance," they say, "is posed by MMT, the manganese-based gasoline additive," recently banned in Canada but still allowed for use in the United States (see related article, [\*Crime Times\*, Vol. 2, No. 2, Page 3](#)).

Masters et al. stress that "neurotoxicity is only one cause among many, at most functioning as a catalyst which, in addition to poverty, social stress, alcohol or drug abuse, individual character, and other social factors, increases the likelihood that an individual will commit a violent crime." But reducing even this one risk among many is an important goal, they say, "given the extraordinary level of violence that persists in urban America and the failure of traditional policies to meet it."

*Masters, Chair of the Executive Committee of the Gruter Institute for Law and Behavioral Research and Nelson A. Rockefeller Professor of Government at Dartmouth College, is currently investigating possible relationships between lead, water fluoridation, and behavior. Crime Times will inform readers about the results of this research as they become available.*

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"Environmental pollution, neurotoxicity, and criminal violence," Roger D. Masters, Brian Hone, and Anil Doshi, in *Environmental Toxicology*, J. Rose, ed., Gordon and Breach, publishers, in press. Address: Roger Masters, Dartmouth College, Dept. of Government, 6108 Silsby Hall, Hanover, NH 03755-3547.

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