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A Silent Pandemic: Industrial Chemicals Are Impairing the Brain Development of Children Worldwide

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Boston, MA – Fetal and early childhood exposures to industrial chemicals in the environment can damage the developing brain and can lead to neurodevelopmental disorders (NDDs)—autism, attention deficit disorder (ADHD), and mental retardation. Still, there has been insufficient research done to identify the individual chemicals that can cause injury to the developing brains of children.

In a new review study, published online in The Lancet on November 8, 2006, and in an upcoming print issue of The Lancet, researchers from the Harvard School of Public Health and the Mount Sinai School of Medicine systematically examined publicly available data on chemical toxicity in order to identify the industrial chemicals that are the most likely to damage the developing brain.

The researchers found that 202 industrial chemicals have the capacity to damage the human brain, and they conclude that chemical pollution may have harmed the brains of millions of children worldwide. The authors conclude further that the toxic effects of industrial chemicals on children have generally been overlooked.

To protect children against industrial chemicals that can injure the developing brain, the researchers urge a precautionary approach for chemical testing and control. Such an approach is beginning to be applied in the European Union. It puts in place strong regulations, which could later be relaxed, if the hazard were less than anticipated, instead of current regulations that require a high level of proof. At present in the U.S., requirements for toxicity testing of chemicals are minimal.

“The human brain is a precious and vulnerable organ. And because optimal brain function depends on the integrity of the organ, even limited damage may have serious consequences,” says Philippe Grandjean , adjunct professor at Harvard School of Public Health and the study’s lead author.

One out of every six children has a developmental disability, usually involving the nervous system. Treating NDDs is difficult and costly to both families and society. In recent decades, a gathering amount of evidence has linked industrial chemicals to NDDs. Lead, for example, was the first chemical identified as having toxic effects to early brain development, though its neurotoxicity to adults had been known for centuries.

A developing brain is much more susceptible to the toxic effects of chemicals than an adult brain. During development, the brain undergoes a highly complex series of processes at different stages. An interference—for example, from toxic substances—that disrupts those processes, can have permanent consequences. That vulnerability lasts from fetal development through infancy and childhood to adolescence. Research has shown that environmental toxicants, such as lead or mercury, at low levels of exposure can have subclinical effects—not clinically visible, but still important adverse effects, such as decreases in intelligence or changes in behavior.

Grandjean and co-author Philip J. Landrigan, Professor at Mount Sinai School of Medicine, compiled a list of 202 environmental chemicals known to be toxic to the human brain using the Hazardous Substances Data Bank of the National Library of Medicine and other data sources. (The authors note that the list should not be regarded as comprehensive; for example, the number of chemicals that can cause neurotoxicity in laboratory animal tests exceeds 1,000.)

The authors then examined the published literature on the only five substances on the list—lead, methylmercury, arsenic, PCBs and toluene—that had sufficient documentation of toxicity to the developing human brain in order to analyze how that toxicity had been first recognized and how it led to control of exposure. They found a similar pattern in how the risks of each substance were documented: first, a recognition of adult toxicity and episodes of poisoning among children, followed by a growing body of epidemiological evidence that exposure to lower levels of the substances caused neurobehavioral deficits in children.

“Even if substantial documentation on their toxicity is available, most chemicals are not regulated to protect the developing brain,” says Grandjean. “Only a few substances, such as lead and mercury, are controlled with the purpose of protecting children. The 200 other chemicals that are known to be toxic to the human brain are not regulated to prevent adverse effects on the fetus or a small child.”

Grandjean and Landrigan conclude that industrial chemicals are responsible for what they call a silent pandemic that has caused impaired brain development in millions of children worldwide. It is silent because the subclinical effects of individual toxic chemicals are not apparent in available health statistics. To point out the subclinical risk to large populations, the authors note that virtually all children born in industrialized countries between 1960 and 1980 were exposed to lead from petrol, which may have reduced IQ scores above 130 (considered superior intelligence) by more than half and increased the number of scores less than 70. Today, it’s estimated that the economic costs of lead poisoning in U.S. children are $43 billion annually; for methylmercury toxicity, $8.7 billion each year.

“Other harmful consequences from lead exposure include shortened attention spans, slowed motor coordination and heightened aggressiveness, which can lead to problems in school and diminished economic productivity as an adult. And the consequences of childhood neurotoxicant exposure later in life may include increased risk of Parkinson’s disease and other neurogenerative diseases,” says Landrigan.

The researchers believe that the total impact of the pandemic is much greater than currently recognized. In supplementary documentation (see below for a link), about half of the 202 chemicals known to be toxic to the brain are among the chemicals most commonly used.

Testing chemicals for toxicity is a highly efficient public health measure. However, less than half of the thousands of chemicals currently used in commerce have been tested to assess acute toxicity and, although new chemicals undergo more thorough testing, access to the data may be restricted because companies fear exposing proprietary information. Also, current toxicity testing rarely includes neurobehavioral functions.

“The brains of our children are our most precious economic resource, and we haven’t recognized how vulnerable they are,” says Grandjean. “We must make protection of the young brain a paramount goal of public health protection. You have only one chance to develop a brain.”

To view supplementary documentation on industrial chemicals and risks of toxic effects on brain development, click here:
http://www.hsph.harvard.edu/neurotoxicant/appendix.doc

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("*Developmental Neurotoxicity of Industrial Chemicals,"* The Lancet, November 8, 2006- Vol. 368)

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