TODAY, ONE IN SIX CHILDREN IN THE UNITED STATES HAS A DEVELOPMENTAL OR learning disability. Some experts say many of these may be due in part to early exposures to toxic chemicals. The number of children diagnosed with these disabilities has increased dramatically over the past four decades. While heightened awareness and changes in diagnostic criteria have contributed to this upsurge, they do not fully explain the rise. A recent National Research Council committee concluded that 3 percent of developmental disabilities are due to toxic exposures in the environment and that another 25 percent result from gene-environment interactions.

These disabilities are costly to families and society. The Centers for Disease Control and Prevention (CDC) estimates that each person afflicted with an intellectual disability incurs over $1 million in direct and indirect costs during his or her lifetime.

Since the Toxic Substances Control Act (TSCA) was enacted in 1976, remarkable advances in neuroscience have led to a greatly increased understanding of the developing brain and nervous system. It is now well-established and widely accepted that chemical exposures may cause profound and irreversible brain damage to children at very low doses. During critical windows of vulnerability in prenatal and early brain development, even small chemical disruptions can cause long-term damage to children at levels that do not harm an adult.

The table at the left presents a snapshot of chemicals that may irreversibly harm an infant's developing brain in utero if a mother is exposed during pregnancy.

While a small number of chemicals have been proven toxic to the developing brain, this may

### Prenatal Chemical Exposures & Potential Neurotoxic Effects

<table>
<thead>
<tr>
<th>CHEMICAL</th>
<th>MATERNAL EXPOSURE ROUTE</th>
<th>KNOWN OR POSSIBLE NEUROTOXIC EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bisphenol A (BPA)</td>
<td>Plastics, food containers, water bottles</td>
<td>Hyperactivity, aggression, developmental neurotoxicity</td>
</tr>
<tr>
<td>Chlorpyrifos</td>
<td>Widely used pesticide (Dursban) used on golf courses and in agriculture</td>
<td>Lower birth weight, impaired mental and motor development, behavior problems such as ADHD</td>
</tr>
<tr>
<td>Methylmercury</td>
<td>Emitted by coal-burning power plants and incinerators; exposure via fish</td>
<td>Severe mental retardation at high dose, fetal neurotoxicity with reduced IQ at lower exposures</td>
</tr>
<tr>
<td>Polychlorinated biphenyls (PCBs)</td>
<td>Electrical equipment, insulators, plastics, lubricating oils; exposure via fish</td>
<td>Low birth weight, delayed development, lower IQ, spatial reasoning deficits, growth impairment</td>
</tr>
<tr>
<td>Polybrominated diphenyl ethers (PDBEs)</td>
<td>Flame retardants found in a number of consumer products—computers, mattresses, furniture</td>
<td>Deficits in learning and memory, adverse behavior and physical effects, lower IQ, developmental neurotoxicity</td>
</tr>
</tbody>
</table>

While a small number of chemicals have been proven toxic to the developing brain, this may
represent only the visible tip of a much larger iceberg. Emerging research has found over 200 industrial chemicals to be neurotoxic in adults who are exposed occupationally, and another 1,000 chemicals are known to be neurotoxic in laboratory animals. Of the roughly 3,000 high production volume chemicals in commerce, 80 percent have no information about developmental or pediatric toxicity, and fewer than half have been subjected to basic laboratory testing for toxicity. More than 700 of these chemicals are used in consumer products, and their expanding use results in widespread exposure to chemical mixtures. CDC surveys find measurable levels of over 200 synthetic chemicals in Americans, and virtually all Americans have at least some of these chemicals in their bodies. The toxic potential of these complex mixtures is almost entirely unknown.

ENDNOTES

6 National Research Council, Scientific Frontiers in Developmental Toxicology and Risk Assessment.
15 Julie B. Herbstman et al., “Prenatal Exposure to PBDEs and Neurodevelopment,” Environmental Health Perspectives, [available online ahead of print January 4, 2010], http://dx.doi.org/10.1289/ehp.0901340.
20 Grandjean and Landrigan, “Developmental Neurotoxicity of Industrial Chemicals.”
21 Ibid.