UNIVERSITY OF MARYLAND

SCHOOL OF PUBLIC HEALTH
Maryland Institute for Applied and Environmental Health

Devon C. Payne-Sturges, Dr.P.H.
Assistant Professor
2234L School of Public Health Bldg
College Park, Maryland 20742-2611
301.405.2025 TEL, 301.405.8397 FAX

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Re: SB300 – Pesticides –Use of Chlorpyrifos - Prohibition
Submitted to: The Senate Education, Health and Environmental Affairs Committee
Position: In support of SB 300

Chairman Pinsky and members of the committee,

I am an Assistant Professor with the Maryland Institute for Applied Environmental Health and the Department of Epidemiology and Biostatistics within the University of Maryland School of Public Health. My areas of expertise are children's environmental health, risk assessment and environmental health policy. Prior to joining the faculty at the School of Public Health, I worked for the U.S. Environmental Protection Agency for 12 years. While at U.S. EPA, I managed the human health extramural research portfolio that included cohort studies on how environmental factors, including organophosphate pesticides (OP) such as chlorpyrifos, affect children's health. I refer to this research, which was reviewed by EPA's FIFRA Scientific Advisory Panel (SAP), in my testimony. In addition, I have conducted my own research assessing the neurodevelopmental risks to children from cumulative exposures to OP pesticides.

I am providing this written testimony as an environmental health expert and in my role as a member of Project TENDR (Targeting Environmental Neuro-Developmental Risks). TENDR is an alliance of more than 50 leading scientists, health professionals, and children's health advocates with expertise on chemicals and brain development. In 2016, TENDR published a Consensus Statement as a national call to action to significantly reduce exposures to chemicals, including chlorpyrifos and other OP pesticides, that are contributing to neurodevelopmental disorders in America's children (Bennett et al., 2016). Project TENDR concluded that the evidence of significant risks to children's neurodevelopment from exposure to chlorpyrifos and other OPs pesticide warrants strong regulatory action. The TENDR consensus statement (see attached) is supported by leading health care, medical, scientific organizations such as the American College of Obstetricians and Gynecologists, the American Public Health Association, the American Nurses Association, and the National Medical Association.

Consistent with the TENDR recommendations, I strongly support the passage of Senate Bill 300 to ban all uses of chlorpyrifos in the State, without any weakening amendments. We need to follow EPA scientists' lead. They did not recommend any exemptions and neither should Maryland legislators. I believe that this bill is essential to help protect the health of Maryland's most vulnerable populations, pregnant women and children.

The main points I will cover briefly are the following: 1) scientific evidence accumulated over nearly two decades that shows chlorpyrifos is a powerful developmental neurotoxicant; 2) EPA's 2016 Revised Human Health Risk assessment for Chlorpyrifos documents that current levels chlorpyrifos exposures from food and drinking water are unsafe for pregnant women and children and 3) Maryland's children deserve "reasonable certainty of not harm".

Chlorpyrifos is a powerful developmental neurotoxicant. Exposures to even very low doses of chlorpyrifos during critical windows over pregnancy can result in child cognitive problems and motor delays (Rauh et al., 2006, 2011, 2015; Whyatt et al. 2005). Further, effects appear to be persistent and potentially life-long. Specifically, chlorpyrifos in umbilical cord blood at birth has been associated with mental and motor delays in preschool age children; with reductions in IQ and working memory when the children reach elementary school age; and with moderate to mild hand tremor hand tremors among the children at age 11 years. The association with reductions in working memory are of particular concern as working memory skills in the elementary school years are a strong predictor of learning outcomes and academic achievement in later years *(*Alloway et al. 2010). Higher versus lower umbilical cord chlorpyrifos concentrations was also associated with maternal report of behavioral problems including attention, ADHD and pervasive developmental disorders (Rauh et al., 2006). Further, application of chlorpyrifos to agricultural fields within 1.5 km of the home during pregnancy has been associated with an increased incidence of autism spectrum disorders in a recent study (Shelton et al., 2014). It should be noted that pregnant women and children living near agricultural fields as well as children of farmworkers are exposed to chlorpyrifos through drift and volatilization (Coronado et al. 2011; Bradman et al., 2005; Thompson et al., 2014; Wofford et al., 2014; Calvert et al., 2008). Additionally, in a pilot study high versus low umbilical cord chlorpyrifos concentrations were associated with changes in brain volume measured using magnetic resonance imaging among children at ages 6-11 years (Rauh 2012). The changes were seen in regions of the brain responsible for attention, receptive language processing, social cognition, and regulation of inhibition. The neuroanatomic alterations may constitute a pathway from pesticide exposure to the associated behavioral and cognitive deficits.

The epidemiologic results are consistent with data from toxicological studies which found disruption in neuronal development, neurotransmitter systems and synaptic formation as well as behavioral and cognitive impairments in test animals following low-dose perinatal chlorpyrifos exposure (Slotkin 2004; Aldridge et al. 2004, 2005; Slotkin and Seidler, 2005, Levin et al 2001; Roy et al., 2004; Garcia et al., 2002).

Current levels of chlorpyrifos residues in fruits, vegetables, and drinking water are unsafe. In 2016, the U.S. EPA carefully and thoughtfully followed the recommendations of its FIFRA Scientific Advisory Panel (SAP) and improved the risk assessment for chlorpyrifos to account for prenatal exposures that result in adverse neurodevelopmental effects. The SAP concluded that the negative effects seen in children across multiple studies were occurring below a dose that causes acetylcholinesterase **(**AChE) inhibition in adults (EPA 2014, 2016). The SAP agreed that these effects were also supported by animal (toxicological) studies. EPA's 2016 revised human health risk assessment uses neurodevelopmental effects as the critical effect, taking into account the SAP recommendations on deriving a point of departure, a level of chlorpyrifos exposure in blood that is considered protective for children's neurodevelopment, for estimating risk. (EPA 2016) In comparing target risk level to protect the developing brains and nervous systems of children, EPA concluded that the current residues (amount) of chlorpyrifos on fruits and vegetables regularly consumed by women and children, as well as concentrations in drinking water were above "acceptable levels". The analysis found that current exposures are at 62 times above acceptable levels for women of reproductive ages and 140 times acceptable levels for young children. Additionally EPA confirmed that chlorpyrifos is estimated to be at unsafe levels in air in residential areas adjacent to agricultural fields because of spray drift from pesticide applications. Following the requirements under the federal Food Quality Protection Act, EPA concluded that all food tolerances should be banned and therefore agricultural uses of chlorpyrifos should be eliminated.

Maryland's children deserve "reasonable certainty of no harm." Children experience greater exposure to organophosphate pesticides due to their increased hand-to-mouth action, and relative to adults they eat more fruits and vegetables, drink more, and breathe more. The 1996 Food Quality Protection Act specifically requires EPA to take into account specific risks to infants and children, including the developing fetus, when setting standards. In setting or revising tolerances for pesticides in food, EPA must determine that "there is a reasonable certainty that no harm will result from aggregate exposure to the pesticide chemical residue,

including all anticipated dietary exposures and all other exposures for which there is reliable information." Although the 9th Circuit Court of Appeals has ordered U.S. EPA to "to revoke all tolerances and cancel all

registrations for chlorpyrifos" based on the scientific evidence and requirements under the law, U.S. EPA's appeal of this ruling will likely mean a resolution will not be reached for years. Maryland should act now on the mounting evidence of neurodevelopmental risk following chlorpyrifos exposures and the EPA 2016 risk assessment that exposure to pregnant women and children are well above levels of health concern and thus should enact SB 300 to eliminate all uses of chlorpyrifos in order to ensure "reasonable certainty of no harm" and protect all of Maryland's children.

In closing, chlorpyrifos is an organophosphate insecticide, a member of class of chemicals deliberately engineered to be toxic to the brain and nervous system. **Twenty years ago**, chlorpyrifos was banned from residential use because exposure from residential use, particularly to children, was determined by the U.S. EPA to be above safe levels.(Browner 2000) Yet it still widely today used on fruits and vegetables and other crops across the U.S. and in Maryland specifically and the use has resulted in concentrations in both food and drinking water that are not safe for pregnant women and children and to substantial exposures to women and children from air contamination resulting from volatilization off agricultural fields. I strongly urge Maryland General Assembly to pass SB 300 to provide needed protection of Maryland residents.

Respectfully,
Devon Payne-Sturges, DrPH
Assistant Professor

Addendum: Regarding length of time it took EPA to propose revocation of all remaining uses of chlorpyrifos in 2015 and 2016. I am well versed on the issue given my work at EPA and specifically my work on chlorpyrifos and other organophosphates as noted in my submitted testimony.

It is important to put the 16 year timeframe for chlorpyrifos into perspective by comparing to other pesticide revocation decisions. EPA has banned only 141 (less than 1%) of about 16,000 registered pesticides. Here are timelines from first limitations on use to cancellation of all approved uses for a few example pesticides that are currently banned: DDT (14 years); Chlordane (10 years); 1,2-Dibromo-3-chloropropane (8 years); and Sodium Fluoroacetate (18 years). DDT is probably the most well-known among these examples. In 1958, USDA began to phase out the department's own use of DDT. But it was Rachel Carson's 1962 book *Silent Spring* that brought the public's attention to the harms caused by DDT. From that point, specific uses for DDT were cancelled overtime until in 1972, when EPA canceled all remaining crop uses of DDT in the United States. EPA was sued by manufacturers of DDT and but prevailed in federal court.

Chlorpyrifos followed a similar path. In 2000, EPA entered a negotiated settlement with the manufacturers of chlorpyrifos to end uses deemed the most harmful to children (e.g. in-home use) but allowed other uses deemed to be less harmful (e.g. in agriculture) to continue. This was, in my opinion, response to pressure from the manufactures so they could continue selling their product. However, in 2007 a petition was filed by the Pesticide Action Network and the Natural Resources Defense Council against EPA seeking a ban on chlorpyrifos based on the growing evidence of risks and harms to children's brains. EPA delayed in responding to this petition and instead used the time to seek advice from the FIFRA Scientific Advisory Panel (SAP) on review of the science. When EPA began to review the studies correlating chlorpyrifos exposures with damage to children's brains in response to the 2007 petition, it found such a correlation. It submitted its analysis to EPA's SAP on multiple occasions beginning in **2008,** and each time, the SAP confirmed EPA's conclusion that early life exposures to chlorpyrifos pose a risk of long-lasting, adverse cognitive, behavioral, and motor impairments. And both EPA and the SAP found that the exposures associated with **serious damage to children's brains were far below the regulatory endpoint used by EPA in its 2001 and 2006 re-registration determinations** which established the chlorpyrifos tolerances currently in effect.

In July 2011, EPA released its Preliminary Human Health Risk Assessment, which confirmed the need to address drift, volatilization, and health impacts to children at low doses. The assessment expressed concern that current tolerances may not afford sufficient protection to children from drinking water. *(EPA, Reader's*

Guide to the Preliminary Human Health Risk Assessment for Chlorpyrifos at 1-3 July 1, 2011; EPA-HQ-OPP-2008-0850-0027.

In 2012, EPA convened its SAP to review EPA's more comprehensive analysis of the neurotoxicity of chlorpyrifos. In its report, the SAP noted significant, long-term adverse effects on neurobehavioral development from chlorpyrifos in laboratory animal studies. It found that the epidemiology "studies show some consistent associations relating exposure measures to abnormal reflexes in the newborn, pervasive development disorder at 24 or 36 months, mental development at 7-9 years, and attention and behavior problems at 3 and 5 years of age.") The Panel concurred with EPA and the 2008 SAP that "chlorpyrifos likely plays a role in impacting the neurodevelopmental outcomes examined in the three cohort studies, drift exposures, particularly infants. (https://www.regulations.gov/document?D=EPA-HQ-OPP-2012-0040-0029)

Seven years after the original petition by Pesticide Action Network and Natural Resources Defense Council and following several lawsuits and delays, EPA had still not acted on the petition. In September 2014, on behalf of PAN and NRDC, Earthjustice filed a petition in the 9th Circuit Court of Appeals to compel EPA to act on the petition.

2014: **In December 2014, EPA released its *Revised Human Health Risk Assessment*** *for Chlorpyrifos ("2014 RHHRA")* and acknowledged the strong convergence in the findings from the animal studies and the three mother-child cohort studies. It found that the laboratory animal studies indicated "that gestational and/or postnatal exposure may cause persistent behavioral effects into adulthood ...upon review of the published literature a pattern of neurodevelopmental adverse outcomes emerges." It called the cohort studies strong studies which **support a conclusion that chlorpyrifos causes long-lasting damage to children's brains at exposures lower than EPA's regulatory endpoint**. The 2014 risk assessment also documented unsafe chlorpyrifos exposures from drinking water contamination. *(Chlorpyrifos: Revised Human Health Risk Assessment for Registration Review; Dec. 29, 2014 ; EPA- HQ-OPP-2008-0850-0195).*

The following year, while criticizing EPA's delays, the 9th Circuit Court of Appeals court ordered EPA to issue a final response to the petition by October 31, 2015.

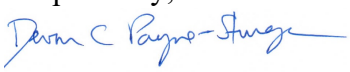
2015: In 2015, EPA proposed to revoke all chlorpyrifos tolerances based on the findings from the 2014 risk assessment (Nov. 6, 2015). In the proposed revocation rule, EPA explicitly and repeatedly found chlorpyrifos unsafe.

EPA recognized that its 2014 risk assessment and 2015 proposed tolerance revocation did not address the greatest risks and most sensitive endpoint, as EPA policy requires and therefore, continued to explore ways to establish an exposure limit that would protect children from neurodevelopmental harm. Each method it explored revealed more serious risks from chlorpyrifos than the 2014 risk assessment.

2016: In November 2016, EPA released its second revised human health risk assessment using a regulatory endpoint designed to guard against damage to children's brains**. That risk assessment found unsafe exposures from every way that people come into contact with chlorpyrifos—on food, in drinking water, through pesticide drift, and from applying the pesticide or working in fields that had recently been sprayed. EPA indicated it had found no chlorpyrifos uses that meet the FQPA safety standard and all chlorpyrifos tolerances would need to be revoked.** *(Revised Human Health Risk Assessment for Registration Review; Nov. 3, 2016; EPA- HQ-OPP-2015-0653-0454)*

In summary, the delays on chlorpyrifos are related to industry pressure, the EPA Office of Pesticide Programs pursuing multiple reviews of the science before responding to petitions, court involvement and slow acceptance by EPA's Office Pesticide Programs that indeed acetylcholinesterase inhibition in adults, the regulatory endpoint used by EPA in its 2001 and 2006 re-registration determinations, was not protective of children's neurodevelopment.

Respectfully,



Devon Payne-Sturges, DrPH
Assistant Professor

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Project TENDR: Targeting Environmental Neuro-Developmental Risks. The TENDR Consensus Statement

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Summary: Children in America today are at an unacceptably high risk of developing neurodevelopmental disorders that affect the brain and nervous system including autism, attention deficit hyperactivity disorder, intellectual disabilities, and other learning and behavioral disabilities. These are complex disorders with multiple causes—genetic, social, and environmental. The contribution of toxic chemicals to these disorders can be prevented. **Approach:** Leading scientific and medical experts, along with children's health advocates, came together in 2015 under the auspices of Project TENDR: Targeting Environmental Neuro-Developmental Risks to issue a call to action to reduce widespread exposures to chemicals that interfere with fetal and children's brain development. Based on the available scientific evidence, the TENDR authors have identified prime examples of toxic chemicals and pollutants that increase children's risks for neurodevelopmental disorders. These include chemicals that are used extensively in consumer products and that have become widespread in the environment. Some are chemicals to which children and pregnant women are regularly exposed, and they are detected in the bodies of virtually all Americans in national surveys conducted by the U.S. Centers for Disease Control and Prevention. The vast majority of chemicals in industrial and consumer products undergo almost no testing for developmental neurotoxicity or other health effects. **Conclusion:** Based on these findings, we assert that the current system in the United States for evaluating scientific evidence and making health-based decisions about environmental chemicals is fundamentally broken. To help reduce the unacceptably high prevalence of neurodevelopmental disorders in our children, we must eliminate or significantly reduce exposures to chemicals that contribute to these conditions. We must adopt a new framework for assessing chemicals that have the potential to disrupt brain development and prevent the use of those that may pose a risk. This consensus statement lays the foundation for developing recommendations to monitor, assess, and reduce exposures to neurotoxic chemicals. These measures are urgently needed if we are to protect healthy brain development so that current and future generations can reach their fullest potential.

A Call to Action

The TENDR Consensus Statement is a call to action to reduce exposures to toxic chemicals that can contribute to the prevalence of neurodevelopmental disabilities in America's children. The TENDR authors agree that widespread exposures to toxic chemicals in our air, water, food, soil, and consumer products can increase the risks for cognitive, behavioral, or social impairment, as well as specific neurodevelopmental disorders such as autism and attention deficit hyperactivity disorder (ADHD) (Di Renzo et al. 2015; Gore et al. 2015; Lanphear 2015; Council on Environmental Health 2011). This preventable threat results from a failure of our industrial and consumer markets and regulatory systems to protect the developing brain from toxic chemicals. To lower children's risks for developing neurodevelopmental disorders, policies and actions are urgently needed to eliminate or significantly reduce exposures to these chemicals. Further, if we are to protect children, we must overhaul how government agencies and business assess risks to human health from chemical exposures, how chemicals in commerce are regulated, and how scientific evidence informs decision making by government and the private sector.

Trends in Neurodevelopmental Disorders

We are witnessing an alarming increase in learning and behavioral problems in children. Parents report that 1 in 6 children in the United States, 17% more than a decade ago, have a developmental disability, including learning disabilities, ADHD, autism, and other developmental delays (Boyle et al. 2011). As of 2012, 1 in 10 (> 5.9 million) children in the United States are estimated to have ADHD (Bloom et al. 2013). As of 2014, 1 in 68 children in the United States has an autism spectrum disorder (based on 2010 reporting data) (CDC 2014).

The economic costs associated with neurodevelopmental disorders are staggering. On average, it costs twice as much in the United States to educate a child who has a learning or developmental disability as it costs for a child who does not (Chambers et al. 2004). A recent study in the European Union found that costs associated with lost IQ points and intellectual disability arising from two categories of chemicals—polybrominated diphenyl ether flame retardants (PBDEs) and organophosphate (OP) pesticides—are estimated at 155.44 billion euros ($169.43 billion dollars) annually (Bellanger et al. 2015). A 2009 analysis in the United States found that for every $1 spent to reduce exposures to lead, a potent neurotoxicant, society would benefit by $17–$221 (Gould 2009).

Vulnerability of the Developing Brain to Chemicals

Many toxic chemicals can interfere with healthy brain development, some at extremely low levels of exposure (Adamkiewicz et al. 2011; Bellinger 2008; Committee on Improving Analysis Approaches Used by the U.S. EPA 2009; Zoeller et al. 2012). Research in the neurosciences has identified "critical windows of vulnerability" during embryonic and fetal development, infancy, early childhood and adolescence (Lanphear 2015; Lyall et al. 2014; Rice and Barone 2000). During these windows of development, toxic chemical exposures may cause lasting harm to the brain that interferes with a child's ability to reach his or her full potential.

The developing fetus is continuously exposed to a mixture of environmental chemicals (Mitro et al. 2015). A 2011 analysis of the U.S. Centers for Disease Control and Prevention's (CDC) biomonitoring data found that 90% of pregnant women in the United States have detectable levels of 62 chemicals in their bodies, out of 163 chemicals for which the women were screened (Woodruff et al. 2011). Among the chemicals found in the vast majority of pregnant women are PBDEs, polycyclic aromatic hydrocarbons (PAHS), phthalates, perfluorinated compounds, polychlorinated biphenyls (PCBs), perchlorate, lead and mercury (Woodruff et al. 2011). Many of these chemicals can cross the placenta during pregnancy and are routinely detected in cord blood or other fetal tissues (ATSDR 2011; Brent 2010; Chen et al. 2013; Lien et al. 2011).

Prime Examples of Neurodevelopmentally Toxic Chemicals

The following list provides prime examples of toxic chemicals that can contribute to learning, behavioral, or intellectual impairment, as well as specific neurodevelopmental disorders such as ADHD or autism spectrum disorder:

- Organophosphate (OP) pesticides (Eskenazi et al. 2007; Fortenberry et al. 2014; Furlong et al. 2014; Marks et al. 2010; Rauh et al. 2006; Shelton et al. 2014).
- PBDE flame retardants (Chen et al. 2014; Cowell et al. 2015; Eskenazi et al. 2013; Herbstman et al. 2010).
- Combustion-related air pollutants, which generally include PAHs, nitrogen dioxide and particulate matter, and other air pollutants for which nitrogen dioxide and particulate matter are markers (Becerra et al. 2013; Clifford et al. 2016; Jedrychowski

et al. 2015; Kalkbrenner et al. 2014; Suades-González et al. 2015; Volk et al. 2013).
- Lead (Eubig et al. 2010; Lanphear et al. 2005; Needleman et al. 1979).
- Mercury (Grandjean et al. 1997; Karagas et al. 2012; Sagiv et al. 2012).
- PCBs (Eubig et al. 2010; Jacobson and Jacobson 1996; Schantz et al. 2003).

The United States has restricted some of the production, use and environmental releases of these particular chemicals, but those measures have tended to be too little and too late. We face a crisis from both legacy and ongoing exposures to toxic chemicals. For lead, OP pesticides, PBDEs and air pollution, communities of color and socioeconomically stressed communities face disproportionately high exposures and health impacts (Adamkiewicz et al. 2011; Engel et al. 2015; Zota et al. 2010).

Policies to ban lead from gasoline, paints and other products have been successful in lowering blood lead levels in the American population (Jones et al. 2009), yet lead exposure continues to be a preventable cause of intellectual impairment, ADHD and maladaptive behaviors for millions of children (CDC 2015). Scientists agree that there is no safe level of lead exposure for fetal or early childhood development (Lanphear et al. 2005; Schnur and John 2014), and studies have documented the potential for cumulative and synergistic health effects from combined exposure to lead and social stressors (Bellinger et al. 1988; Cory-Slechta et al. 2004). Thus, taking further preventive actions is imperative.

Epidemiological, toxicological, and mechanistic studies have together provided evidence that clearly demonstrates or strongly suggests neurodevelopmental toxicity for lead, mercury, OP pesticides, air pollution, PBDEs, and PCBs. The level and type of available evidence linking exposures to toxic chemicals with neurodevelopmental disorders, including the examples in this statement, vary both within and among chemical classes. In light of this extensive evidence and continued widespread exposure, the risks for learning and developmental disorders can likely be lowered through targeted exposure reduction, starting with these example chemicals.

Majority of Chemicals Untested for Neurodevelopmental Effects

The examples of developmental neurotoxic chemicals that we list here likely represent the tip of the iceberg. Of the tens of thousands of chemicals on the U.S. Environmental Protection Agency (EPA) chemical inventory, nearly 7,700 are manufactured or imported into the United States at ≥ 25,000 pounds per year (U.S. EPA 2012). The U.S. EPA has identified nearly 3,000 chemicals that are produced or imported at > 1 million pounds per year (U.S. EPA 2006).

Only a minority of chemicals has been evaluated for neurotoxic effects in adults. Even fewer have been evaluated for potential effects on brain development in children (Grandjean and Landrigan 2006, 2014). Further, toxicological studies and regulatory evaluation seldom address combined effects of chemical mixtures, despite evidence that all people are exposed to dozens of chemicals at any given time.

Need for a New Approach to Evaluating Evidence

Our failures to protect children from harm underscore the urgent need for a better approach to developing and assessing scientific evidence and using it to make decisions. We as a society should be able to take protective action when scientific evidence indicates a chemical is of concern, and not wait for unequivocal proof that a chemical is causing harm to our children.

Evidence of neurodevelopmental toxicity of any type—epidemiological or toxicological or mechanistic—by itself should constitute a signal sufficient to trigger prioritization and some level of action. Such an approach would enable policy makers and regulators to proactively test and identify chemicals that are emerging concerns for brain development and prevent widespread human exposures.

Some chemicals, like those that disrupt the endocrine system, present a concern because they interfere with the activity of endogenous hormones that are essential for healthy brain development. Endocrine-disrupting chemicals (EDCs) include many pesticides, flame retardants, fuels, and plasticizers. One class of EDCs that is ubiquitous in consumer products are the phthalates. These are an emerging concern for interference with brain development and therefore demand attention (Boas et al. 2012; Ejaredar et al. 2015; Mathieu-Denoncourt et al. 2015; Miodovnik et al. 2014; U.S. Consumer Product Safety Commission 2014).

Regrettable Substitution

Under our current system, when a toxic chemical or category of chemicals is finally removed from the market, chemical manufacturers often substitute similar chemicals that may pose similar concerns or be virtually untested for toxicity. This practice can result in "regrettable substitution" whereby the cycle of exposures and adverse effects starts all over again. The following list provides examples of this cycle:
- When the federal government banned some uses of OP pesticides, manufacturers responded by expanding the use of neonicotinoid and pyrethroid pesticides. Evidence is emerging that these widely used classes of pesticides pose a threat to the developing brain (Kara et al. 2015; Richardson et al. 2015; Shelton et al. 2014).
- When the U.S. Government reached a voluntary agreement with flame retardant manufacturers to stop making PBDEs, the manufacturers substituted other halogenated and organophosphate flame retardant chemicals. Many of these replacement flame retardants are similar in structure to other neurotoxic chemicals but have not undergone adequate assessment of their effects on developing brains.
- When the federal government banned some phthalates in children's products, the chemical industry responded by replacing the banned chemicals with structurally similar new phthalates. These replacements are now under investigation for disrupting the endocrine system.

Looking Forward

Our system for evaluating scientific evidence and making decisions about environmental chemicals is broken. We cannot continue to gamble with our children's health. We call for action now to prevent exposures to chemicals and pollutants that can contribute to the prevalence of neurodevelopmental disabilities in America's children.

We need to overhaul our approach to developing and assessing evidence on chemicals of concern for brain development. Toward this end, we call on regulators to follow scientific guidance for assessing how chemicals affect brain development, such as taking into account the special vulnerabilities of the developing fetus and children, cumulative effects resulting from combined exposures to multiple toxic chemicals and stressors, and the lack of a safety threshold for many of these chemicals (Committee on Improving Analysis Approaches Used by the U.S. EPA 2009). We call on businesses to eliminate neurodevelopmental toxicants from their supply chains and products, and on health professionals to integrate knowledge about environmental toxicants into patient care and public health practice.

Finally, we call on policy makers to take seriously the need to reduce exposures of all children to lead—by accelerating the clean up from our past uses of lead such as in paint and water pipes, by halting the current uses of lead, and by better regulating the industrial processes that cause new lead contamination.

We are confident that reducing exposures to chemicals that can interfere with healthy brain development will help to lower the prevalence of neurodevelopmental disabilities, and thus enable many more children to reach their full potential.

TENDR Statement Authors

Scientists

Deborah Bennett, PhD
Associate Professor, Department of Public Health Sciences, School of Medicine, University of California, Davis

David C. Bellinger, PhD, MSc
Boston Children's Hospital
Harvard Medical School
Harvard T.H. Chan School of Public Health

Linda S. Birnbaum, PhD, DABT, A.T.S
Director, National Institute of Environmental Health Sciences,
Director, National Toxicology Program

Asa Bradman, PhD, MS
Associate Director, Center for Environmental Research and Children's Health (CERCH)
Associate Adjunct Professor of Environmental Health Sciences, School of Public Health, UC Berkeley

Aimin Chen, MD, PhD
Associate Professor, Division of Epidemiology
Department of Environmental Health
University of Cincinnati College of Medicine

Deborah A. Cory-Slechta, PhD
Professor of Environmental Medicine, Pediatrics and Public Health Sciences;
Acting Chair, Department of Environmental Medicine;
Director, University of Rochester Medical School Environmental Health Sciences Center

Stephanie M. Engel, PhD
Associate Professor, Department of Epidemiology,
Gillings School of Global Public Health University of North Carolina, Chapel Hill

M. Daniele Fallin, PhD
Sylvia and Harold Halpert Professor and Chair,
Dept. of Mental Health; Director, Wendy Klag Center for Autism and Developmental Disabilities, Johns Hopkins Bloomberg School of Public Health

Alycia Halladay, PhD
Chief Science Officer, Autism Science Foundation, Adjunct, Dept. of Pharmacology and Toxicology,
Rutgers University

Russ Hauser, MD, ScD, MPH
Frederick Lee Hisaw Professor of Reproductive Physiology; Professor of Environmental and Occupational Epidemiology, Harvard T.H. Chan School of Public Health; Professor of Obstetrics, Gynecology and Reproductive Biology, Harvard Medical School

Irva Hertz-Picciotto, PhD
Director, UC Davis Environmental Health Sciences Center; Professor,
Department of Public Health Sciences & Medical Investigations of Neurodevelopmental Disorders (MIND) Institute,
University of California, Davis

Carol F. Kwiatkowski, PhD
Executive Director, The Endocrine Disruption Exchange (TEDX)
Assistant Professor Adjunct, Dept. of Integrative Physiology, University of Colorado, Boulder

Bruce P. Lanphear, MD, MPH
Clinician Scientist, Child & Family Research Institute, BC Children's Hospital
Professor, Faculty of Health Sciences, Simon Fraser University, Vancouver, BC

Emily Marquez, PhD
Staff Scientist
Pesticide Action Network North America

Melanie Marty, PhD
Adjunct Associate Professor
University of California, Davis

Jennifer McPartland, PhD
Senior Scientist
Environmental Defense Fund

Craig J. Newschaffer, PhD
Director, A.J. Drexel Autism Institute
Professor, Epidemiology and Biostatistics,
Drexel University

Devon Payne-Sturges, DrPH
Assistant Professor, Maryland Institute for Applied Environmental Health,
School of Public Health,
University of Maryland

Heather B. Patisaul, PhD
Professor, Biological Sciences, Center for Human Health and the Environment,
WM Keck Center for Behavioral Biology, NC State University

Frederica P. Perera, DrPH, PhD
Professor of Public Health
Director, Columbia Center for Children's Environmental Health; Professor, Dept. of Environmental Health Sciences, Mailman School of Public Health, Columbia University

Beate Ritz MD, PhD
Professor of Epidemiology
Center for Occupational and Environmental Health
Fielding School of Public Health, University of California Los Angeles

Jennifer Sass, PhD
Senior Scientist, Natural Resources Defense Council
Professorial Lecturer, George Washington University

Susan L. Schantz, PhD
Professor of Toxicology and Neuroscience, Illinois Children's Environmental Health Research Center; Director, Beckman Institute for Advanced Science and Technology, University of Illinois, Urbana-Champaign

Thomas F. Webster, DSc
Professor, Department of Environmental Health, Boston University School of Public Health

Robin M. Whyatt, DrPH
Professor Emeritus, Department of Environmental Health Sciences, Mailman School of Public Health, Columbia University

Tracey J. Woodruff, PhD, MPH
Professor and Director, Program on Reproductive Health and the Environment,
Dept. of Obstetrics, Gynecology and Reproductive Sciences, University of California, San Francisco

R. Thomas Zoeller, PhD
Professor of Biology
Director, Laboratory of Molecular & Cellular Biology,
University of Massachusetts Amherst

Health Professionals and Providers

Laura Anderko, PhD, RN
Robert and Kathleen Scanlon Endowed Chair in Values Based Health Care & Professor, School of Nursing and Health Studies, Georgetown University,
Director, Mid-Atlantic Center for Children's Health and the Environment

Carla Campbell, MD, MS, FAAP
Visiting Clinical Associate Professor of Public Health University of Texas at El Paso

Jeanne A. Conry, MD, PhD
Past President, American College of Obstetricians and Gynecologists; Assistant Physician in Chief, The Permanente Medical Group

Nathaniel DeNicola, MD, MSHP, FACOG
American College of Obstetricians & Gynecologists Liaison to American Academy of Pediatrics Executive Council on Environmental Health; Clinical Associate in Obstetrics & Gynecology, U. of Pennsylvania

Robert M. Gould, MD
Associate Adjunct Professor, Program on Reproductive Health and the Environment,
Dept. of Obstetrics, Gynecology and Reproductive Sciences, UCSF School of Medicine; Immediate Past President, Physicians for Social Responsibility

Deborah Hirtz, MD
Professor, Neurological Sciences and Pediatrics
University of Vermont School of Medicine

Katie Huffling, RN, MS, CNM
Director of Programs
Alliance of Nurses for Healthy Environments

Philip J. Landrigan, MD, MSc, FAAP
Dean for Global Health, Arnhold Institute for Global Health; Professor of Preventive Medicine and Pediatrics, Icahn School of Medicine at Mount Sinai

Arthur Lavin, MD, FAAP
Advanced Pediatrics
Associate Clinical Professor of Pediatrics
Case Western Reserve University School of Medicine

Mark Miller, MD, MPH
Director, University of California San Francisco Pediatric Environmental Health Specialty Unit

Mark A. Mitchell, MD, MPH
President, Mitchell Environmental Health Associates
Chair, Council on Medical Legislation and
Co-Chair, Commission on Environmental Health
National Medical Association

Leslie Rubin, MD
President, Innovative Solutions for Disadvantage and Disability; Associate Professor, Dept. of Pediatrics, Morehouse School of Medicine; Co-director, Southeast Pediatric Environmental Health Specialty Unit, Emory University; Medical Director, Developmental Pediatric Specialists

Ted Schettler, MD, MPH
Science Director
Science and Environmental Health Network

Ho Luong Tran, MD, MPH
President and CEO
National Council of Asian Pacific Islander Physicians

Children's Health and Disabilities Advocates

Annie Acosta
Director of Fiscal and Family Support Policy
The Arc

Charlotte Brody, RN
National Coordinator, Healthy Babies Bright Futures Vice President of Health Initiatives, BlueGreen Alliance

Elise Miller, MEd
Director, Collaborative on Health and the Environment (CHE)

Pamela Miller, MS
Executive Director
Alaska Community Action on Toxics

Maureen Swanson, MPA
Healthy Children Project Director
Learning Disabilities Association of America

Nsedu Obot Witherspoon, MPH
Executive Director, Children's Environmental Health Network

Organizations that Endorse or Support the TENDR Consensus Statement

American College of Obstetricians and Gynecologists (ACOG)
ACOG supports the value of this clinical document as an educational tool (March 2016)

Child Neurology Society

Endocrine Society

International Neurotoxicology Association

International Society for Children's Health and the Environment

International Society for Environmental Epidemiology

National Council of Asian Pacific Islander Physicians

National Hispanic Medical Association

National Medical Association

Address correspondence to I. Hertz-Picciotto, University of California, Davis, Department of Public Health Sciences, MS1C, One Shields Ave., Davis, California USA 95616-8500. Telephone: 530-752-3025. E-mail: ihp@ucdavis.edu; melissarose6899@gmail.com

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D.B. has served as an expert witness in civil litigation cases and criminal cases involving exposures to environmental chemicals. He has been paid for these activities. He has provided opinions for plaintiffs and for defendants, depending on the facts of the case. He also served as a paid expert witness to a Commission of Inquiry into lead contamination in Hong Kong's drinking water. A.B. has served as a consultant to nonprofit organizations developing environmental health educational curricula for child care programs and has participated as a volunteer member on the Board of the Organic Center, a nonprofit organization that provides information for scientific research about organic food and farming. C.K. is employed by The Endocrine Disruption Exchange (TEDX), a U.S. 501(c)3 organization that occasionally provides consultation, legal assistance, or expert testimony on the topic of endocrine-disrupting chemicals. Neither C.K. nor TEDX stands to gain or lose financially through the publication of this article. This work was supported by private foundations that did not have scientific or editorial input or control. J.S. is employed by the Natural Resources Defense Council, an environmental nongovernmental organization (NGO) that routinely engages in public advocacy, lobbying, and litigation to expand protections for the environment and public health and to enforce existing environmental laws regulating toxic chemicals, including some of the chemicals identified in this manuscript. I.H-P. has received travel reimbursements for her service on the Scientific Advisory Committee of Autism Speaks, in which she provided comments on broad directions for the organization's research programs. She also received payment for reviewing grant proposals for the Research Screening Committee of the California Air Resources Board, which is a branch of the California state government involved in air quality regulation. E.M. works at Pesticide Action Network, an NGO advocating for a farming system that is not reliant on pesticides. M.S. is the Director of the Healthy Children Project for the Learning Disabilities Association of America. Her position is funded by the John Merck Fund, which also contributed some of the funding for Project TENDR.

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February 11, 2020

Dear Maryland Legislators,

As scientists in the fields of biology, chemistry, ecology, ecotoxicology, entomology, sustainability and human sciences, we would like to call your attention to the irreparable harm chlorpyrifos has on the environment and human health of Maryland. The 71 signers of this letter urge you to take immediate action to protect your constituents and the environment by passing HB 229 and SB 300, which would ban this dangerous chemical.

Chlorpyrifos is a toxic pesticide derived from a nerve gas developed by Nazi Germany for use in WWII.[1] Although the EPA banned almost all residential use of Chlorpyrifos in 2000, it is still widely used in the agricultural industry.[2] Marylanders regularly come into contact with chlorpyrifos through residue on food and contaminated drinking water and air. In 2015, a Food and Drug Administration study found that chlorpyrifos is the fourth most common pesticide found in human foods.[3]

Scientific studies have linked chlorpyrifos to brain damage in children, autism, cancer, Parkinson's disease and a whole host of other negative human health impacts such as reduced IQ, loss of working memory, attention deficit disorders and delayed motor development.[4,5,6,7] Farmers, farmworkers, and rural communities have an increased risk of exposure to chlorpyrifos due to proximity to agriculture, which is associated with immediate and long-term adverse health impacts.[8,9,10]

A large body of science, including the U.S. Environmental Protection Agency's scientific review demonstrates that chlorpyrifos residues in water and food are unsafe for pregnant women and children.[11] In fact, studies indicate there are no safe levels for pregnant women since chlorpyrifos exposure can result in negative health outcomes for both the mother and fetus, such as increasing the chance of having a preterm birth.[12]

Chlorpyrifos is also extremely damaging to wildlife, namely birds, fish and pollinators. Federal scientists concluded this pesticide poses a risk to about 1,800 critically threatened or endangered species.[13] Chlorpyrifos contributes to the staggering decline of pollinators because of its sub-lethal effect on bees. In a Chesapeake Bay Program report, chlorpyrifos was found in 90 percent of Bay samples with 40 percent having concentrations exceeding thresholds.[14] Studies have found that chlorpyrifos can have negative physiological, mutagenic, and sub-lethal effects on aquatic life.[15,16,17]

Safer alternatives exist for addressing challenging pests on farms, including on orchards, vineyards, golf courses and land care.

Due to the surmounting evidence of chlorpyrifos' toxicity to humans and the environment, the U.S. Environmental Protection Agency (EPA) experts determined there was no safe way to use the chemical and recommended a complete ban.[18,19] However, former EPA Administrator Scott Pruitt denied the petition to ban chlorpyrifos as one of his first formal acts in office.[20,21]

As a result, numerous state attorneys general, including Maryland Attorney General Brian Frosh, have filed suit against the EPA challenging its ruling.[22] The state of Hawaii responded by banning chlorpyrifos and both California and New York have initiated proceedings to ban it as well.[23] In August 2018, the U.S. Court of Appeals for the Ninth Circuit ordered EPA to ban chlorpyrifos within 60 days.[24]Days before the deadline, EPA and the Department of Justice appealed the decision and requested a re-hearing. [25]

As scientists and academics, we agree that the body of evidence on chlorpyrifos' detrimental effects to human health and the environment is conclusive. We urge the state legislature to take action where the

federal government has failed. We strongly ask that Maryland legislators champion human health and environmental stewardship by passing HB 229 and SB 300 to ban the use of chlorpyrifos in Maryland this congressional session.

Sincerely,

Dr. Pedro Barbosa
Entomology Department
University of Maryland

Dr. Neil Blough
Department of Chemistry and Biochemistry
University of Maryland

Dr. April Boulton
Associate Professor of Biology
Hood College

Dr. Rachel Brewster
Department of Biological Sciences
University of Maryland, Baltimore County

Dr. Mark Bulmer
Biology Department
Towson University

Dr. Priscila Chaverri
Department of Plant Science and Landscape Architecture
University of Maryland

Dr. Jane Clark
Department of Kinesiology
School of Public Health
University of Maryland

Dr. Peter Craig
Department of Chemistry
McDaniel College

Dr. Thomas Cronin
Department of Biological Sciences
University of Maryland, Baltimore County

Dr. Elizabeth Dahl
Department of Chemistry
Loyola University

Dr. Marie-Christine Daniel
Department of Chemistry and Biochemistry
University of Maryland, Baltimore County

Dr. Jeffery Davis
Department of Chemistry and Biochemistry
University of Maryland

Dr. Kim Derrickson
Department of Biology
Loyola University Maryland

Dr. John Desmond
Department of Neurology
The John Hopkins University

Dr. Christopher Ellis
Department of Plant Science and Landscape Architecture
University of Maryland

Dr. Anne Estes
Department of Biological Sciences
Towson University

Dr. Alexandra Fairfield
Department of Biology
Montgomery College

Dr. Paul Ferraro
School of Public Health
The John Hopkins University

Dr. Quentin Gaudry
Department of Biology
University of Maryland

Dr. Alan Goldberg
Department of Environmental Health and Engineering
The John Hopkins University

Dr. Shane Hall
Department of Environmental Studies
Salisbury University

Dr. Ellen Hondrogiannis
Department of Chemistry

Towson University

Dr. Ben Hurley
School of Public Health
University of Maryland, Baltimore County

Dr. Phillip Johnson
Department of Biology
University of Maryland

Dr. Sammy Joseph
School of Public Health
University of Maryland

Dr. Sara Kalifa
Department of Biology
Montgomery College

Dr. Marciel Kann
Department of Biological Sciences
University of Maryland, Baltimore County

Dr. Joanne Klossner
Department of Kinesiology
University of Maryland

Dr. Andrew Koch
Department of Chemistry
St. Mary's College of Maryland

Dr. Megan Latshaw
School of Public Health
The John Hopkins University

Dr. Robert Lawrence
Bloomberg School of Public Health
The John Hopkins University

Dr. Bernard Lohr
Department of Biology
University of Maryland, Baltimore County

Dr. Carlos MacHado
Department of Biology
University of Maryland

Dr. Mira Mehta
Department of Nutrition and Food Science
University of Maryland

Dr. Stephen Miller
Department of Biological Sciences
University of Maryland, Baltimore County

Dr. Melanie Nillson
Department of Chemistry
McHenry College

Dr. Devon Payne-Sturges
Maryland Institute for Applied Environmental Health
University of Maryland
Dr. Nora Pisanic
Department of Environmental Health and Engineering
The John Hopkins University

Dr. Robin Van Meter
Biology and Environmental Studies
Washington College

Dr. Timothy Pruett
Department of Geography and Environmental Planning
Towson University

Dr. Kim Quillin
Department of Biological Sciences
Salisbury University

Dr. Gurumurthy Ramachandran
Bloomberg School of Public Health
The Johns Hopkins University

Dr. Michael Raupp
Department of Entomology
University of Maryland

Dr. Stephen Roth
School of Public Health
University of Maryland

Dr. Ana Rule
Director, Exposure Assessment Lab
The Johns Hopkins University

Dr. Nadine Sahyoun
Department of Nutrition and Food Science
University of Maryland

Dr. Thurka Sangaramoorth
Department of Anthropology

University of Maryland

Dr. Amir Sapkota
Maryland Institute for Applied Environmental Health
University of Maryland

Dr. Charles Schmitz
Department of Geography
Towson University

Dr. Eric Schoenberger
Department of Environmental Health and Engineering
The Johns Hopkins University

Dr. Hal Schreier
Marine Biotechnology and Biology
University of Maryland, Baltimore County

Dr. Alan Scott
Bloomberg School of Public Health
The Johns Hopkins University

Dr. Jason Scullion
Chair, Department of Environmental Studies
McDaniel College

Leo Shapiro
Lecturer, College of Agriculture
University of Maryland

Dr. Leslie Sherman
Department of Chemistry and Environmental Science
Washington College

Dr. Erik Silldorf
Department of Biological Sciences
Towson University

Dr. Photini Sinnis
School of Public Health
The Johns Hopkins University

Dr. Genee Smith
School of Public Health
The Johns Hopkins University

Dr. Ernst Spannhake
Department of Environmental Health and Engineering
The Johns Hopkins University

Dr. Paporn Thebpanya
Department of Geography and Environmental Planning
Towson University

Dr.Marie-Christine Thoma
School of Public Health
University of Maryland

Dr. Eric Toner
Bloomberg School of Public Health
The John Hopkins University

Dr. Troy Townsend
Department OF Chemistry
St. Mary's College of Chemistry

Dr. Dennis Vacante
School of Public Health
University of Maryland

Dr. Robin Van Meter
Biology and Environmental Science & Studies
Washington College

Dr. Sara Via
Entomology Department
University of Maryland

Dr. Cynthia Wagner
Department of Biology
University of Maryland

Dr. Virginia Weaver
Department of Environmental Health and Engineering
The Johns Hopkins University

Dr. Gerald Wilkinson
Department of Biology
University of Maryland

Dr. Marsha Wills-Karp
Department of Environmental Health and Engineering
The Johns Hopkins University

Dr. Benjamin Zaitchik
Department of Earth & Planetary Sciences
The John Hopkins University

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