



Michigan Network for  
**CHILDREN'S**  
**Environmental**  
**HEALTH**

117 N. Division  
Ann Arbor, MI 48104  
734.761.3186 x108

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# Michigan Network for Children's Environmental Health

**Genevieve K. Howe, MPH**  
**Environmental Health Campaign Director**

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# Presentation Outline

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- Michigan Network for Children's Environmental Health
  - The nature of the problem
  - Examples of links between chemicals and disabilities and mental health outcomes.
  - Michigan Network for Children's Environmental Health – Priority work.
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# The Michigan Network – Who We Are

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- A network of organizations and individuals dedicated to a safe and less toxic world for Michigan's children.
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# The Michigan Network – Our Mission

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- Advocate for policies and practices that protect Michigan's children from environmental toxicants.





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# The Michigan Network – Members

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- Health professional groups
  - Health-affected groups
  - Environmental and environmental justice groups
  - Other organizations & individuals
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# The Nature of the Problem

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- Children are uniquely vulnerable.
  - 85,000 synthetic chemicals in use – very few have been tested.
  - We know some common chemicals are potent neurotoxicants.
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# Why Children?

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- Children breathe, drink, & eat 2 1/2 times more pound for pound than adults.
  - Increased metabolic rate.
  - Smaller body size.
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# Why Children?

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- Live closer to the floor.
- Hand-to-mouth behavior.
- Children's developing bodies and brains are more vulnerable.
- Children are the future.



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# Why Children?

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- Studies show some common industrial chemicals can contribute to developmental, learning, & behavioral disabilities in children, as well as mental health disorders.

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Source: In Harm's Way: Toxic Threats to Child Development, Greater Boston Physicians for Social Responsibility, <http://psr.igc.org/ihw-project.htm>



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# Why Children?

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- Nearly 12 million children (17%) under age 18 in the US suffer from one or more learning, developmental, or behavioral disability.

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Source: In Harm's Way: Toxic Threats to Child Development, Greater Boston Physicians for Social Responsibility, <http://psr.igc.org/ihw-project.htm>



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# Why Children?

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- Learning disabilities alone affect 5-10% of children in public schools
- ADHD conservatively affects 3-8% of all school children; CDC reported 7.8% in 2003 (ages 4-17)
- Marked increase in autism reported in CA and elsewhere; cannot be fully explained by changes in diagnostic criteria or increased reporting

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Source: In Harm's Way: Toxic Threats to Child Development, Greater Boston Physicians for Social Responsibility, <http://psr.igc.org/ihw-project.htm>



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# Why Children?

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Nationally:

- At least 1 in 5 children and adolescents have a mental health disorder.
- At least 1 in 10, or about 6 million young people, have a serious emotional disturbance.

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Source: U.S. HHS, Substance Abuse and Mental Health Services Administration (SAMHSA), National Mental Health Information Center, <http://mentalhealth.samhsa.gov/child/childhealth.asp>



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# A delicate balance

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*“Every cell is precisely in its place, every link between neurons carefully organized. Nothing is random, nothing arbitrary — the unfolding of brain development is like a precisely choreographed dance.”*



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# A delicate balance

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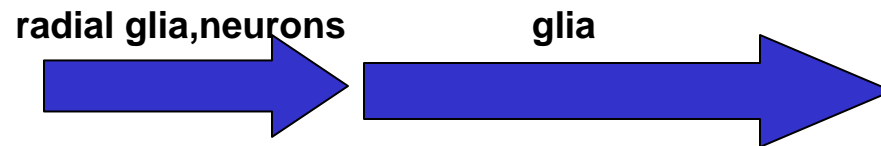
The brain continues to develop and change throughout childhood, adolescence, adulthood, and old age.

**When a substance interferes with these clearly-defined dance steps, problems can occur.**

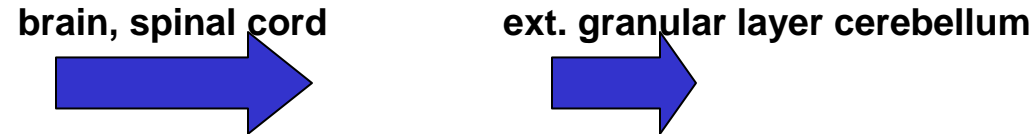
# Time Lines of Developmental Processes in Humans

Prenatal Period (Months)      Postnatal Period (Years)  
 0 1 2 3 4 5 6 7 8 9 Birth 1 2 3 4 5 6 7 8 9 10

**Cell Proliferation**



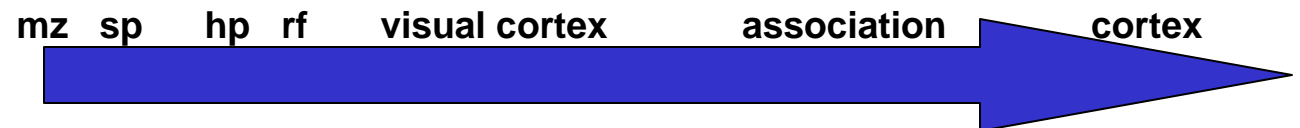
**Migration of Neurons**



**Subplate Neurons**



**Synapse Formation**



**Myelination (see text)**



Key: mz – marginal zone; sp – subplate; hp – hippocampus; rf – reticular formation

# Causes of mental health disorders in children and adolescents

→ Mostly Biology and Environment.

Examples of Biological causes:

- Genetics
- Chemical imbalances in the body
- Damage to the central nervous system, such as a head injury.

# Causes of mental health disorders in children and adolescents

## Examples of Environmental factors:

- Exposure to environmental toxins, such as high levels of lead;
- Exposure to violence – witnessing or being the victim of physical or sexual abuse, drive-by shootings, muggings, or other disasters;
- Stress related to: chronic poverty, discrimination, or other serious hardships;
- Loss of important people – death, divorce, or broken relationships.

Source: U.S. HHS, Substance Abuse and Mental Health Services Administration (SAMHSA), National Mental Health Information Center, <http://mentalhealth.samhsa.gov/child/childhealth.asp>

# Emerging Science on Neurotoxicants & Children's Health

- Lower IQ
- Learning problems
- Memory problems
- Attention deficit
- Behavior changes

Source: "Linking Environmental Exposures with Psychological Disorders" Fact Sheet, March 2006, CHE - Learning & Developmental Disabilities Initiative, [www.iceh.org/LDDI.html](http://www.iceh.org/LDDI.html).

# Emerging Science on Neurotoxicants & Children's *Mental* Health (less well developed)

- Anxiety
- Depression
- Conduct disorders
- Schizophrenia

Source: "Linking Environmental Exposures with Psychological Disorders" Fact Sheet, March 2006, CHE - Learning & Developmental Disabilities Initiative, [www.iceh.org/LDDI.html](http://www.iceh.org/LDDI.html).

# Caution!

- Most evidence is based on high-dose exposures (accidents, occupational)
- Even less is known about the impacts of low-dose and chronic exposures to neurotoxic agents.
- Some data is based on animal studies, which cannot always be applied to humans.
- We know very little about the combined effects of being exposed to multiple toxins.

Source: “Linking Environmental Exposures with Psychological Disorders” Fact Sheet, March 2006, CHE - Learning & Developmental Disabilities Initiative, [www.iceh.org/LDDI.html](http://www.iceh.org/LDDI.html).

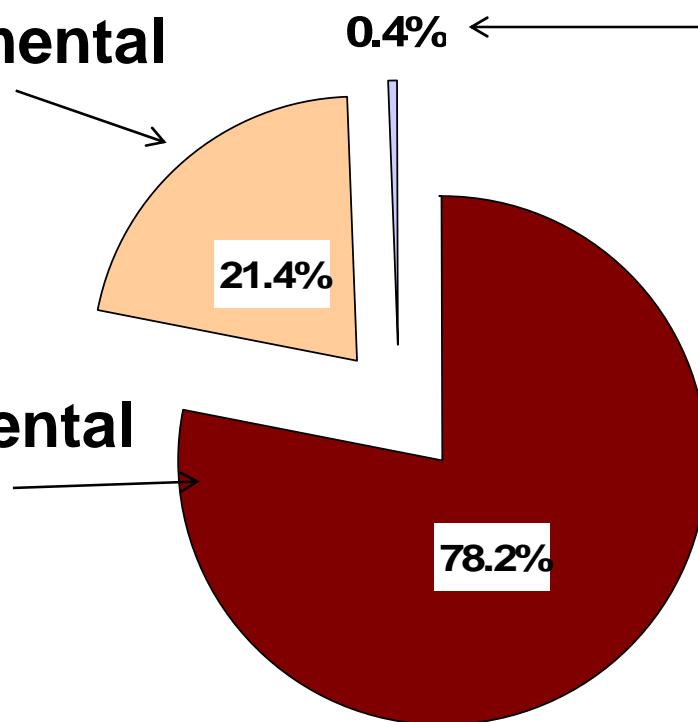
# Status of Developmental Toxicity Testing for the 2,863 Chemicals Produced *Above 1 million pounds/year*

**Some Data**

**On Developmental  
Toxicity**

**No Data**

**On Developmental  
Toxicity**



**12 Tested for  
Neurodevelopmental  
Toxicity  
According to EPA  
Guidelines**

# Lead

Also recognized as neurodevelopmental toxicant for years. Associated with:

- Impaired IQ
- Learning disabilities
- Attention deficit
- Hyperactivity
- Impulsiveness
- Aggression
- Symptoms of anxiety
- Symptoms of depression
- Anti-social behavior
- Delinquent behavior, trouble with the law
- Failure to complete school
- Possibly w/ schizophrenia & bipolar disorder

Source: "Linking Environmental Exposures with Psychological Disorders" Fact Sheet, March 2006, CHE - Learning & Developmental Disabilities Initiative, [www.iceh.org/LDDI.html](http://www.iceh.org/LDDI.html).

# Lead

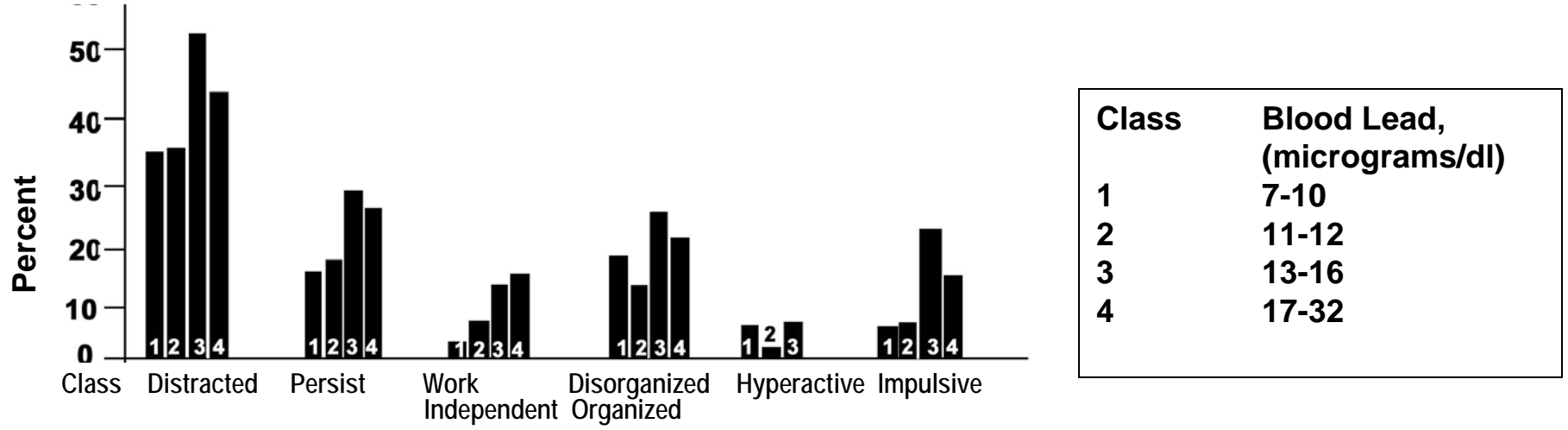
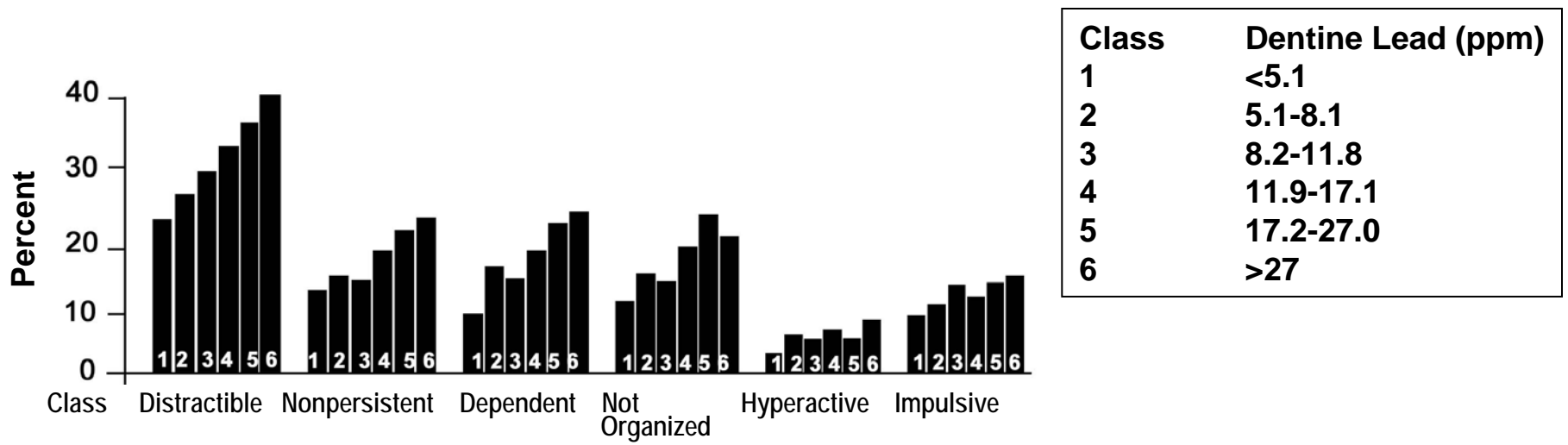
- Lead-exposed foundry workers w/ over 40 micrograms per deciliter of lead in their blood, showed increased rates of:
  - Depression
  - Confusion
  - Anger
  - Fatigue
  - Tension

Source: “Linking Environmental Exposures with Psychological Disorders” Fact Sheet, March 2006, CHE - Learning & Developmental Disabilities Initiative, [www.iceh.org/LDDI.html](http://www.iceh.org/LDDI.html).

# Lead

- One study found that lead exposure during pregnancy may be associated with schizophrenia later in life.
- Another study found that lead may overstimulate an enzyme implicated in bipolar disorder and schizophrenia. It suggests that lead may have a greater impact on people who are genetically predisposed.

# Association of Teacher Ratings With Student Lead Burden





# Mercury

## Effects of Higher Dose Prenatal Exposure

- Mental retardation
- Seizures
- Cerebral palsy
- Disturbances of vision, hearing, sensation
- Abnormal gait
- Abnormal speech
- Disturbances of swallowing and sucking
- Abnormal reflexes

# Mercury—low dose effects, prenatal exposure

- Impairments (at age 7-9) of:
  - motor skills
  - attention
  - visual spatial skills
  - language
  - memory
-  blood pressure,  heart rate variability

# Mercury

2 small occupational studies of workers:

- 1) Long term exposure to high levels of organic mercury:
  - Anxiety
  - Depression
  - Phobic avoidance
- 2) Acute exposure to inorganic mercury vapor:
  - Anxiety
  - Depression
  - Social withdrawal

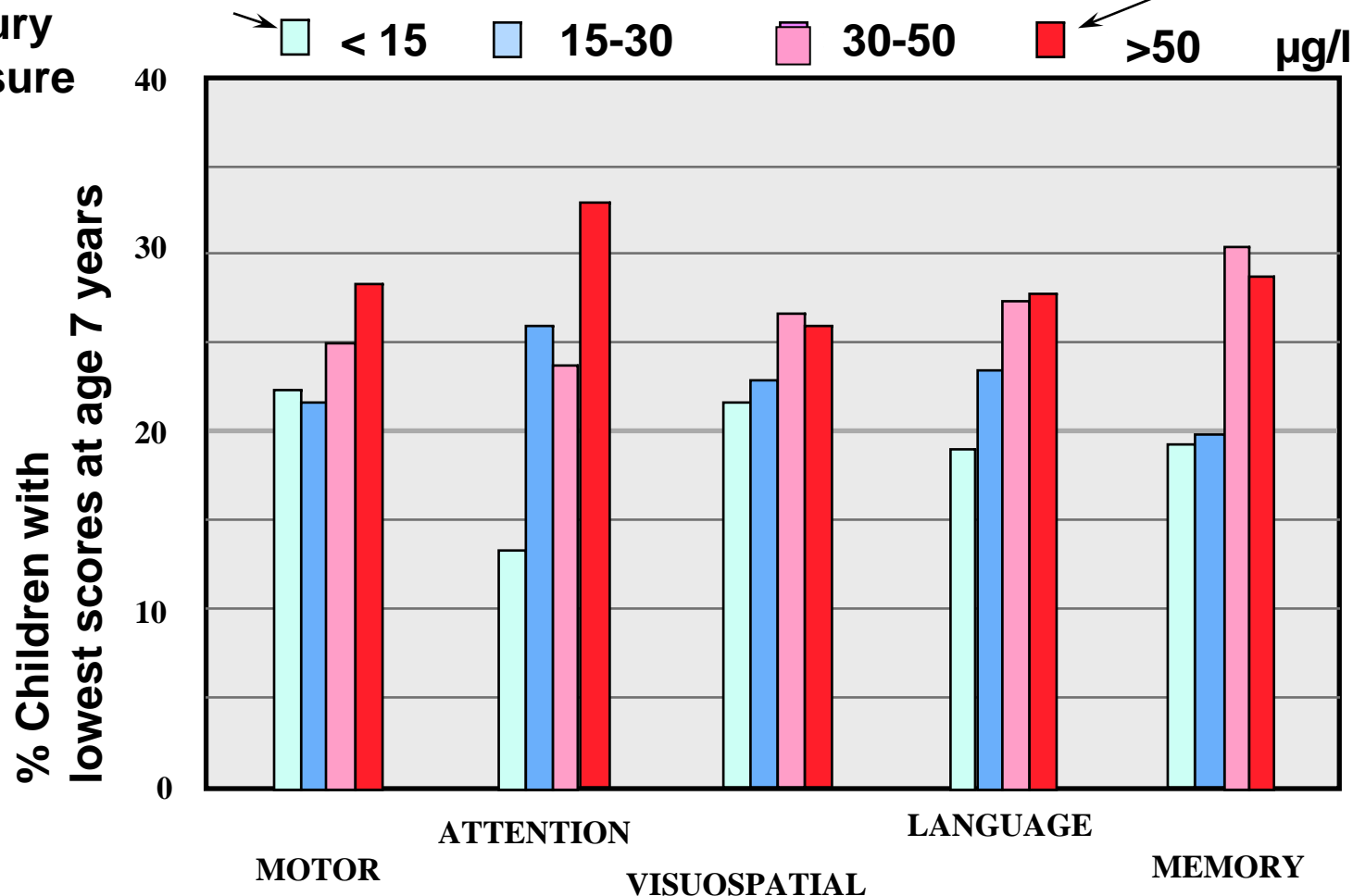
Source: “Linking Environmental Exposures with Psychological Disorders” Fact Sheet, March 2006, CHE - Learning & Developmental Disabilities Initiative, [www.iceh.org/LDDI.html](http://www.iceh.org/LDDI.html).

# Mercury

## Effects of Low Dose Prenatal Exposure

Children with low prenatal mercury exposure

Children with high prenatal mercury exposure



Source: Grandjean, et. al., "Cognitive Deficit in 7-year-Old Children with Prenatal Exposure to Methylmercury", Neurotoxicology and Teratology, Vol. 19, No. 6, 1997

Figure shows prenatal mercury exposure levels of Faroese children with scores in the lowest quartile after adjustment for cofounders. For each of the five major cognitive functions, one neuropsychological test with a high psychometric validity was selected.

# PCBs

- Pervasive developmental effects
- Alter neurotransmitter levels
- Interfere with TH mediated gene transcription
- **Developmental Implications:** Elevated maternal TSH during pregnancy, with or without reductions of thyroid hormone, associated with reduced IQ at age 7-9 yrs.

(Haddow, NEJM, 1999)

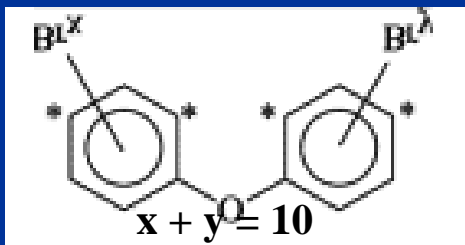
# Brominated flame retardants (BFRs)

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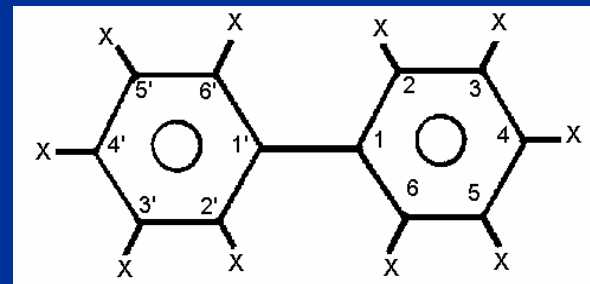
- Organic chemicals containing the element bromine.
- Added to products to inhibit ignition or spread of flames.
- Over 75 different brominated flame retardants.

# Some of the most commonly used BFRs resemble PCBs

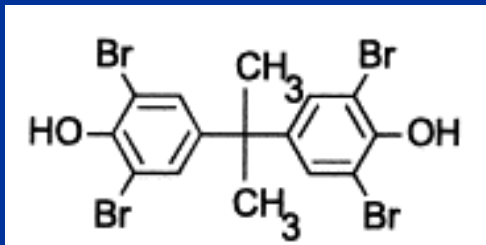
Over 150 million pounds annually



**PBDEs**



**PCBs**



**TBBPA**

# PBDE

## Neurodevelopmental Studies

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- Exposure to PBDEs (Penta, Octa, Deca) during critical windows of brain development results in decreased memory and learning that worsens with age. (Eriksson, 2001; Viberg, 2003)
- No human neurodevelopmental data
- High-end human levels approach those that cause impacts in animal studies.
- May also act through thyroid hormone disruption

# Pesticides

Colorado farm residents using herbicides and insecticides showed that effects of poisonings included:

- Decreased concentration
- Increased irritability

Source: “Linking Environmental Exposures with Psychological Disorders” Fact Sheet, March 2006, CHE - Learning & Developmental Disabilities Initiative, [www.iceh.org/LDDI.html](http://www.iceh.org/LDDI.html).

# Pesticides

Study of rats given cyhalothrin (a synthetic pyrethroid insecticide) showed that it can induce:

- Anxiety-like symptoms.

# Organophosphate Pesticides

Brazilian study of 37 workers w/ long term exposure to the organophosphate pesticides chlorpyrifos and acephate showed nearly half had psychiatric diagnoses including:

- Generalized anxiety disorder
- Panic disorder
- Social anxiety

Source: “Linking Environmental Exposures with Psychological Disorders” Fact Sheet, March 2006, CHE - Learning & Developmental Disabilities Initiative, [www.iceh.org/LDDI.html](http://www.iceh.org/LDDI.html).

# Organophosphate Pesticides

Organophosphate pesticide poisonings have been linked to:

- Depression
- Anxiety
- Irritability
- Restlessness

Source: “Linking Environmental Exposures with Psychological Disorders” Fact Sheet, March 2006, CHE - Learning & Developmental Disabilities Initiative, [www.iceh.org/LDDI.html](http://www.iceh.org/LDDI.html).

# Organophosphate Pesticides

- One study of agricultural workers, who stopped using organophosphate pesticides, showed a significant decrease in:
  - Depressive mood disorder

# Organophosphate Pesticides

Farm workers who reported pesticide poisoning were 5 times as likely to exhibit:

- Depression

# Organochlorine Pesticides

- Lindane: (organochlorine)
  - Lowers seizure threshold
  - Reports of infant and child seizures with excess use; occasional infant deaths

Source: "Linking Environmental Exposures with Psychological Disorders" Fact Sheet, March 2006, CHE - Learning & Developmental Disabilities Initiative, [www.iceh.org/LDDI.html](http://www.iceh.org/LDDI.html).

# Organochlorine Pesticides

- An animal study showed that repeated exposure to low levels of lindane may produce persistent changes in:
  - Anxiety-related neural circuitry.

# Solvents

- Alcohol — hyperactivity, cognitive deficits
- Toluene — impacts similar to alcohol
- Other solvents encountered in workplace:
  - Hair stylists, painters, photo lab, graphic design, etc.; at least 8 weeks of pregnancy
  - Children tested at 3-9 yrs old: lower IQ, language, memory, attention; hyperactive
  - (N=32 plus matched controls)

(Laslo-Baker, Arch Pediatr Adolesc Med. 2004)

# Solvents

Occupational exposure to organic solvents has been associated with increased psychiatric symptoms, particularly:

- Depression

# Nicotine

Like alcohol, nicotine has been recognized as a neurodevelopmental toxicant for many years.

Nicotine is associated with:

- IQ deficit, learning and attention deficits

# Food additives

- Double blind, cross-over study; one month;
- 400 children; some hyperactive and some not; each child served as own control;
- Test drink—colors and preservatives
- Outcome—parents reported significant increase in hyperactivity associated with exposure to the test chemicals

(Bateman, Arch Dis Childhood, 2004)

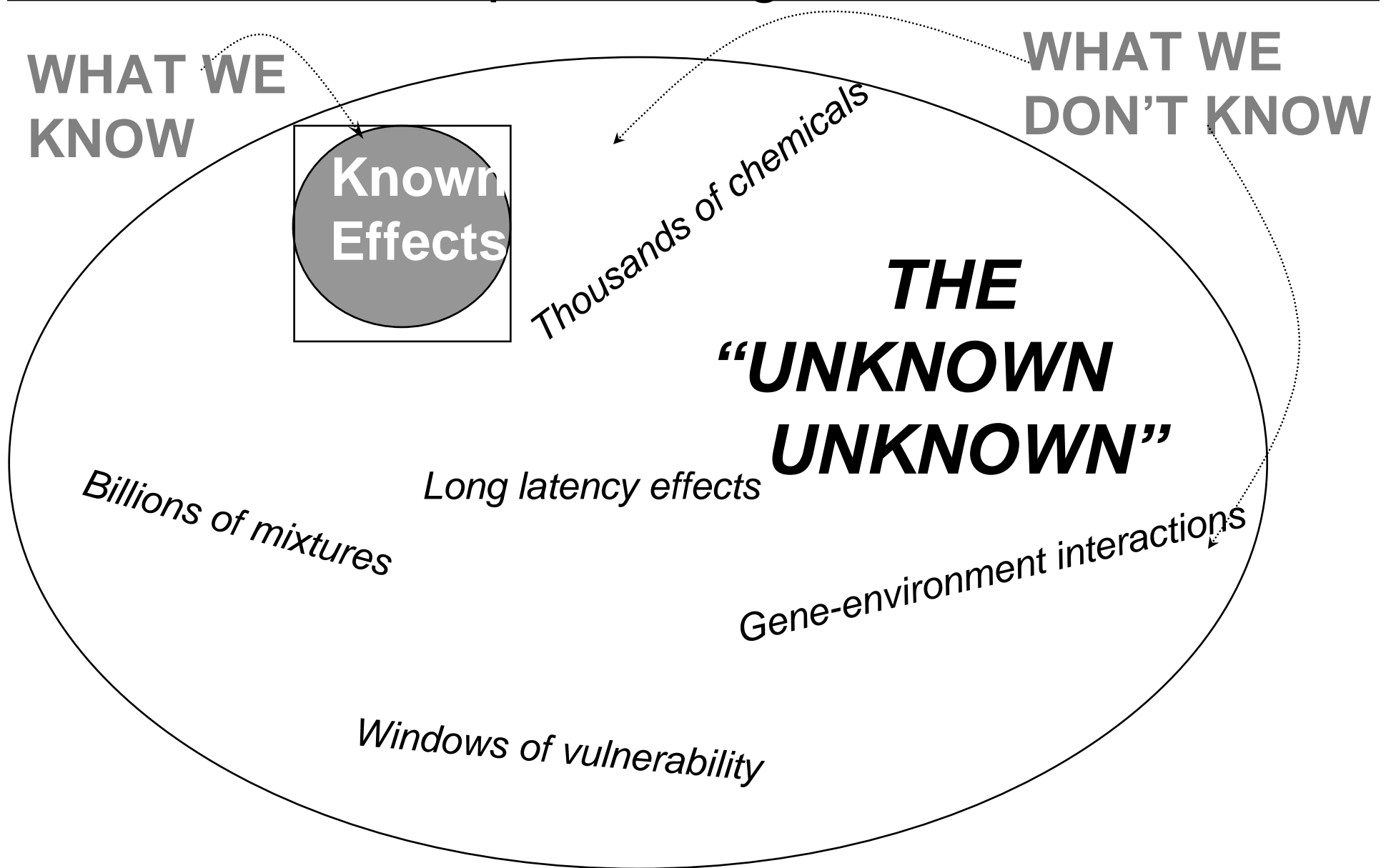
# Summary of *possible* mental health/toxicants links

<b>Exposure:</b>	Anxiety Disorder	Conduct Disorder	Depression	Schizophrenia	Learning, Language, Memory, Attention, IQ
Lead	XX	XX	XX	XX	XX
Mercury	XX		XX		XX
PCBs					XX
PBDEs					XX
Organophosphates	XX		XX		
Solvents/Alcohol	XX	XX	XX		XX
Nicotine					XX
Food Additives		XX			

Source: "Linking Environmental Exposures with Psychological Disorders" Fact Sheet, March 2006, CHE - Learning & Developmental Disabilities Initiative, [www.iceh.org/LDDI.html](http://www.iceh.org/LDDI.html).

# Under-recognition of Toxic Threats: Epistemological Bias

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# Michigan Network for Children's Environmental Health

## Priority work

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# Current Campaigns

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- Children's Products
  - Deca-BDE
  - Lindane
  - Mercury
  - Green Chemistry
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# Children's Products

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- Products sold for use by children too often contain lead and other toxics.
  - Michigan Senate considering HB 4132, HB 4399, and SB 174 re: lead in children's products.
  - Please ask your Senator to strengthen and pass these bills.  
Visit: [www.mnceh.org](http://www.mnceh.org)
-



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# Deca-BDE

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- Deca-BDE is a toxic, very common flame retardant.
  - DEQ advisory committee recommended a legislative ban on deca-BDE.
  - HB 4465 has been introduced in the House.
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# Lindane

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- Phase out pharmaceutical use of lindane in Michigan.
  - HB 5574 has been introduced in the House.
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# Mercury

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- Bills passed in 2006 to phase out mercury-containing products:
    - blood pressure devices
    - thermostats
    - other medical devices
  
  - Bills we hope to see in 2007-08:
    - state purchasing (passed Senate)
    - switches, relays, hydrometers, barometers, & manometers.
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# What is Green Chemistry?

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- An innovative scientific movement aimed at designing safe chemicals and materials
  - A set of principles for chemists and others to develop products, processes and services that curb pollution, waste, and energy consumption.
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# Green Chemistry Examples

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- Plastics made from sustainably-grown Michigan crops that are safe and biodegradable
    - Food packaging made with biodegradable & edible materials
    - Laptop casings that have an enzyme that allows them to be reused
  - Safer solvents and other chemicals made from plants
-



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# Green Chemistry

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- Please ask the Governor to fulfill her Executive Directive on Green Chemistry. Visit: [www.mnceh.org](http://www.mnceh.org).



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# How you can get involved

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- Your organization can apply to become a member,
- or
- You can receive only action alerts and updates,
- or
- You can receive action alerts only.

Visit: [www.mnceh.org](http://www.mnceh.org)

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# **California Bans Use of Six Phthalates in children's products and toys.**

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**October 14, 2007 --**

**"We must take this action to protect our  
children," said Gov. Schwarzenegger.**

**"These chemicals threaten the health and  
safety of our children at critical stages of  
their development."**

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# Questions?

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# Resources: Children and Environmental Toxins

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- Institute for Children's Environmental Health, [www.iceh.org](http://www.iceh.org)
  - Learning Disabilities Association of America - Healthy Children Project [www.healthychildrenproject.org](http://www.healthychildrenproject.org)
  - AAIDD - Environmental Health Initiative, [www.ehinitiative.org](http://www.ehinitiative.org)
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## Resources: Children and Environmental Toxins

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- Learning and Developmental Disabilities Initiative  
[www.iceh.org/LDDI.html](http://www.iceh.org/LDDI.html)
  - Autism Society of America  
[www.autism-society.org](http://www.autism-society.org)
  - Children's Environmental Health Network, [www.cehn.org](http://www.cehn.org)
  - Healthy Schools Network, Inc.  
[www.healthyschools.org](http://www.healthyschools.org)
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# Resources: Children and Environmental Toxins

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- National Association for the Dually Diagnosed, [www.thenadd.org](http://www.thenadd.org)  
NADD Environmental Health Project, <http://www.envhealthproject.org>
  - University of Tennessee Youth Environment and Health Research Group, <http://utyeah.utk.edu>
-