

## **What causes autism? Exploring the environmental contribution**

### **Current Opinion in Pediatrics January 16, 2010**

Philip J Landrigan, MD

From the Department of Community and Preventive Medicine, Department of Pediatrics, Children's Environmental Health Center, Mount Sinai School of Medicine, New York, USA.

#### **FROM ABSTRACT:**

#### **PURPOSE OF REVIEW:**

Autism is a biologically based disorder of brain development.

Genetic factors - mutations, deletions, and copy number variants - are clearly implicated in causation of autism. However, they account for only a small fraction of cases, and do not easily explain key clinical and epidemiological features. This suggests that early environmental exposures also contribute. This review explores this hypothesis.

#### **RECENT FINDINGS:**

Indirect evidence for an environmental contribution to autism comes from studies demonstrating the sensitivity of the developing brain to external exposures such as lead, ethyl alcohol and methyl mercury.

But the most powerful proof-of-concept evidence derives from studies specifically linking autism to exposures in early pregnancy - thalidomide, misoprostol, and valproic acid; maternal rubella infection; and the organophosphate insecticide, chlorpyrifos.

There is no credible evidence that vaccines cause autism.

#### **SUMMARY:**

Children today are surrounded by thousands of synthetic chemicals. Two hundred of them are neurotoxic in adult humans, and 1000 more in laboratory models. Yet fewer than 20% of high-volume chemicals have been tested for neurodevelopmental toxicity.

#### **THIS AUTHOR ALSO NOTES:**

Autism was first described in 1943.

This article explores the contribution of early environmental exposures to toxic chemicals to the causation of autism.

The prevalence of autism is substantially higher than a decade ago. Similar increases are noted in England, Europe, and Japan.

"Genetic factors are thought to account for 7-8% of autism cases." A purely genetic explanation for causation of autism is unlikely.

Environmental chemical toxin exposures can play a role in autism causation. "These factors could act in concert with inherited susceptibilities or through inducing epigenetic changes."

There is "exquisite vulnerability of the developing human brain to toxic exposures."

Exposure of lead and methylmercury toxic chemicals can damage the developing human brain and produce neurodevelopmental disorders and subclinical dysfunction.

"The developing human brain is understood today to be exquisitely susceptible to injury caused by toxic chemicals in the environment. The vulnerability is greatest during embryonic and fetal life, and may be especially great in the first trimester of pregnancy."

The "tip of the iceberg" chemicals that cause neurodevelopmental disabilities include:

- A)) Lead
- B)) Methylmercury
- C)) Polychlorinated biphenyls (PCBs)
- D)) Arsenic
- E)) Manganese
- F)) Organophosphate insecticides
- G)) DDT
- H)) Ethyl alcohol

These authors note:

- A)) There are more than 80,000 chemicals with potential human exposure
- B)) More than 1,000 chemicals are known to be neurotoxic in experiments
- C)) 201 chemicals are known to be neurotoxic in humans
- D)) 8 chemicals are proven to be neurotoxic to human neurodevelopment

"Children today are at risk of exposure to 3,000 synthetic chemicals produced in quantities of more than 1 million pounds per year."

"Given current understanding of the great vulnerability of the developing brain to toxic chemicals, likelihood is high that many of the [documented chemicals] have potential to cause injury to the developing brain and to produce neurodevelopmental disorders," including autism.

There is both clinical and epidemiological evidence that autism is linked to environmental exposure of toxins.

Documented *in utero* exposures that can cause autism include:

- A)) Thalidomide
- B)) Misopostol  
This drug is designed to protect gastric ulcers; it is also used as an abortifacient [a substance that induces abortion]
- C)) Valproic acid  
A drug used as an anticonvulsant, for mood stabilization, epilepsy, bipolar disorder, depression, migraine, and schizophrenia [Depakote, Depakene, Depacon, Stavzor]
- D)) Prenatal rubella infection
- E)) Chlorpyrifos  
"Chlorpyrifos is an organophosphate insecticide widely used until a few years ago to control insects in schools and homes in the US and still used extensively in agriculture." They also cause significant developmental delays, cognitive deficits and attention deficit hyperactivity disorder (ADHD).

This author believes that autism is primarily caused by exposure to high-production-volume (HPV) chemicals to "which women and children today are routinely exposed."

High-production-volume (HPV) chemicals are those produced in quantities greater than 1 million pounds per year, and are commonly found in consumer goods, cosmetics, medications, motor fuels, building materials, etc. "They are routinely detected in air, food, and drinking water. Measurable quantities of several hundred HPV chemicals are found in the blood and urine of nearly all Americans, as well as in human breast milk and the cord blood of newborn infants."

This author suggests that the chemicals most likely to be causative of autism and therefore those that should have the highest priority for study include:

- A)) Organophosphate pesticides
- B)) Organohalogens [when a carbon is bonded to a halogen (fluorine, chlorine, bromine, iodine); used in refrigerators, air conditioners, pesticides, herbicides, and as solvents]
- C)) Phthalates
- D)) Phenols, such as Bisphenol A (BPA)

## CONCLUSIONS:

The genetic contribution to autism is very small.

Most cases of autism are linked to environmental exposures to toxic chemicals.

## KEY POINTS FROM DAN MURPHY

- 1) Autism was first documented in 1943.
- 2) There is historic evidence that autism is linked to exposure to lead, ethyl alcohol and methyl mercury.
- 3) There is proof that autism is linked to prenatal exposure to thalidomide, misoprostol, and valproic acid; maternal rubella infection; and the organophosphate insecticide, chlorpyrifos.
- 4) There is no credible evidence that vaccines cause autism.
- 5) "Children today are surrounded by thousands of synthetic chemicals. Two hundred of them are neurotoxic in adult humans, and 1,000 more in laboratory models. Yet fewer than 20% of high-volume chemicals have been tested for neurodevelopmental toxicity."
- 6) A purely genetic explanation for causation of autism is unlikely. "Genetic factors are thought to account for 7-8% of autism cases."
- 7) Early environmental toxin exposures may contribute to the causation of autism.
- 8) "The developing human brain is understood today to be exquisitely susceptible to injury caused by toxic chemicals in the environment."
- 9) The "tip of the iceberg" chemicals that cause neurodevelopmental disabilities include:
  - A)) Lead
  - B)) Methylmercury
  - C)) Polychlorinated biphenyls (PCBs)
  - D)) Arsenic
  - E)) Manganese
  - F)) Organophosphate insecticides
  - G)) DDT
  - H)) Ethyl alcohol
- 10) "Children today are at risk of exposure to 3,000 synthetic chemicals produced in quantities of more than 1 million pounds per year."
- 11) "Given current understanding of the great vulnerability of the developing brain to toxic chemicals, likelihood is high that many of the [documented chemicals] have potential to cause injury to the developing brain and to produce neurodevelopmental disorders," including autism.

12) There is both clinical and epidemiological evidence that autism is linked to environmental exposure of toxins.

13) Documented *in utero* exposures that can cause autism include:

A)) Thalidomide

B)) Misopostol

This drug is designed to protect gastric ulcers; it is also used as an abortifacient [A substance that induces abortion]

C)) Valproic acid

A drug used as an anticonvulsant, for mood stabilization, epilepsy, bipolar disorder, depression, migraine, and schizophrenia [Depakote, Depakene, Depacon, Stavzor]

D)) Prenatal rubella infection

E)) Chlorpyrifos

"Chlorpyrifos is an organophosphate insecticide widely used until a few years ago to control insects in schools and homes in the US and still used extensively in agriculture." They also cause significant developmental delays, cognitive deficits and attention deficit hyperactivity disorder (ADHD).

14) This author believes that autism is primarily caused by exposure to high-production-volume (HPV) chemicals to "which women and children today are routinely exposed."

15) High-production-volume (HPV) chemicals are those produced in quantities greater than 1 million pounds per year, and are commonly found in consumer goods, cosmetics, medications, motor fuels, building materials, etc. "They are routinely detected in air, food, and drinking water. Measurable quantities of several hundred HPV chemicals are found in the blood and urine of nearly all Americans, as well as in human breast milk and the cord blood of newborn infants."

16) This authors suggest that the chemicals most likely to be causative of autism and therefore those that should have the highest priority for study include:

A)) Organophosphate pesticides

B)) Organohalogenes [when a carbon is bonded to a halogen (fluorine, chlorine, bromine, iodine); used in refrigerators, air conditioners, pesticides, herbicides, and as solvents]

C)) Phthalates

D)) Phenols, such as Bisphenol A (BPA)

17) The genetic contribution to autism is very small.

18) Most cases of autism are linked to environmental exposures to toxic chemicals.