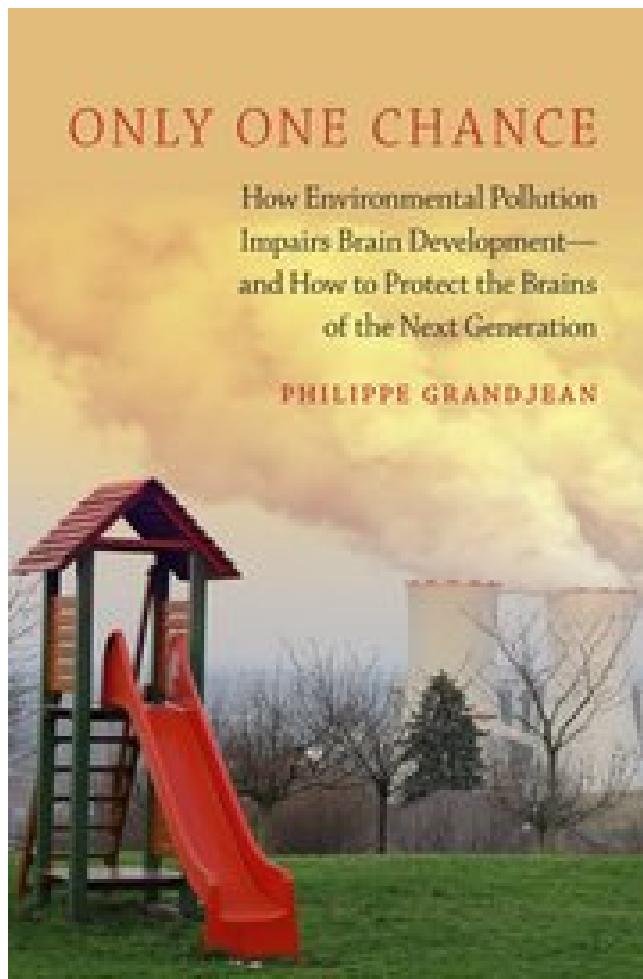


CHE Alaska call

Wednesday, February 4th, 2015

9:00 am Alaska Time (10:00 am Pacific; 1:00 pm Eastern)



Dr. Philippe Grandjean
on **Chemical Brain Drain:**
Only One Chance -
How Contaminants
in our Environment
Impair Brain Development

www.chemicalbraindrain.info



Erroneous and dangerous assumptions:

- The placenta protects the fetus
- Children are just little adults
- Poisonings are reversible
- Proof is needed for regulation
- Testing is too expensive

Sensitive brain development

- **Cell division**

In third trimester about 12,000 nerve cells are formed every minute

- **Differentiation**

Different types of neurons and glia cells

- **Migration**

Distances up to 1,000 times the size of the cell

- **Axon formation**

Total length by age 20 years: 176,000 / 149,000 km (m/f)

- **Generation of synapses**

Up to 1,000 new synapses per second early postnatally

- **Weeding of synapses**

Brain development gone astray

...in every case the mother was healthy,
and it was not until more than three
months after birth that the symptoms
were recognized

Shoji Kitamura (1959)



Photo: W. Eugene Smith

Focal

Widespread

Diffuse

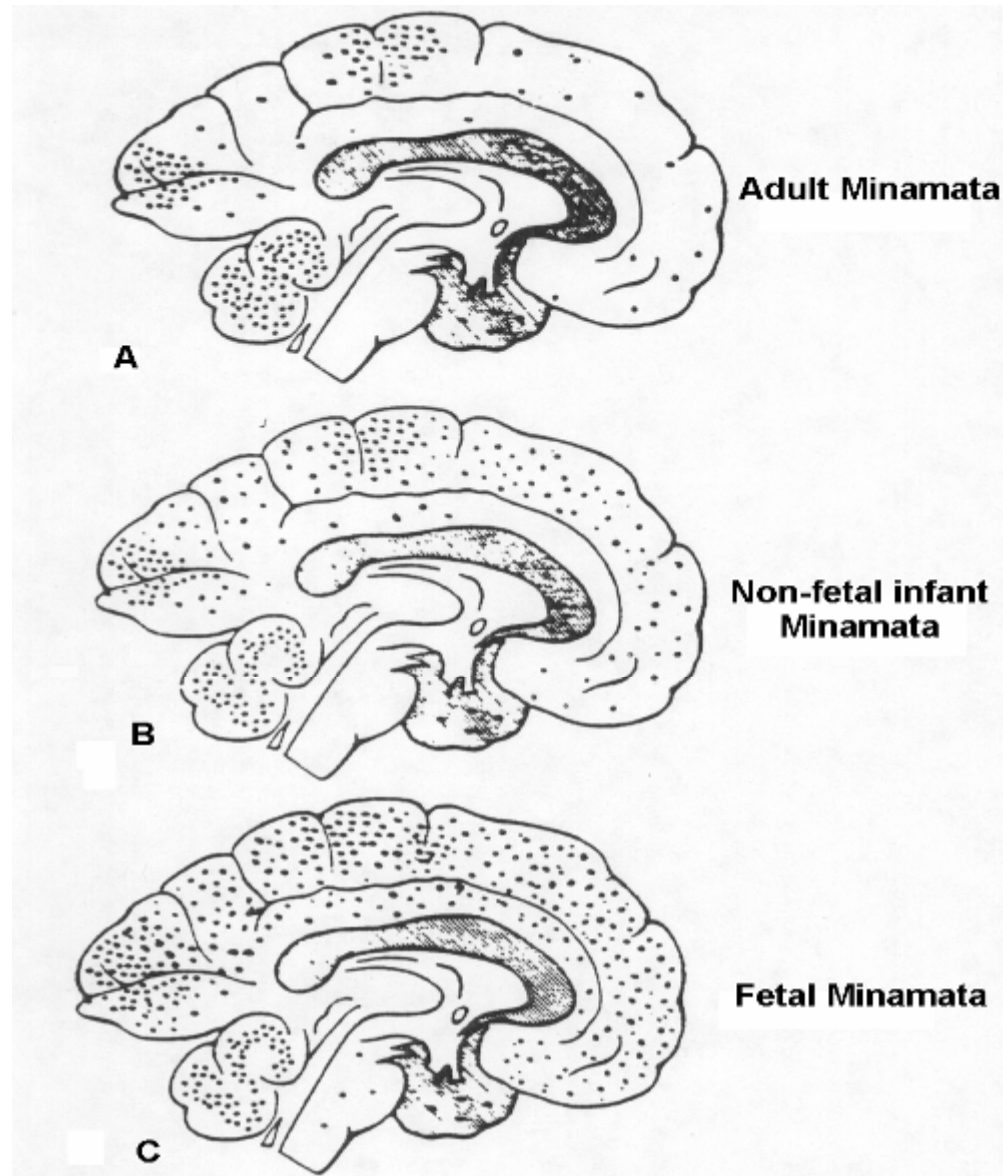
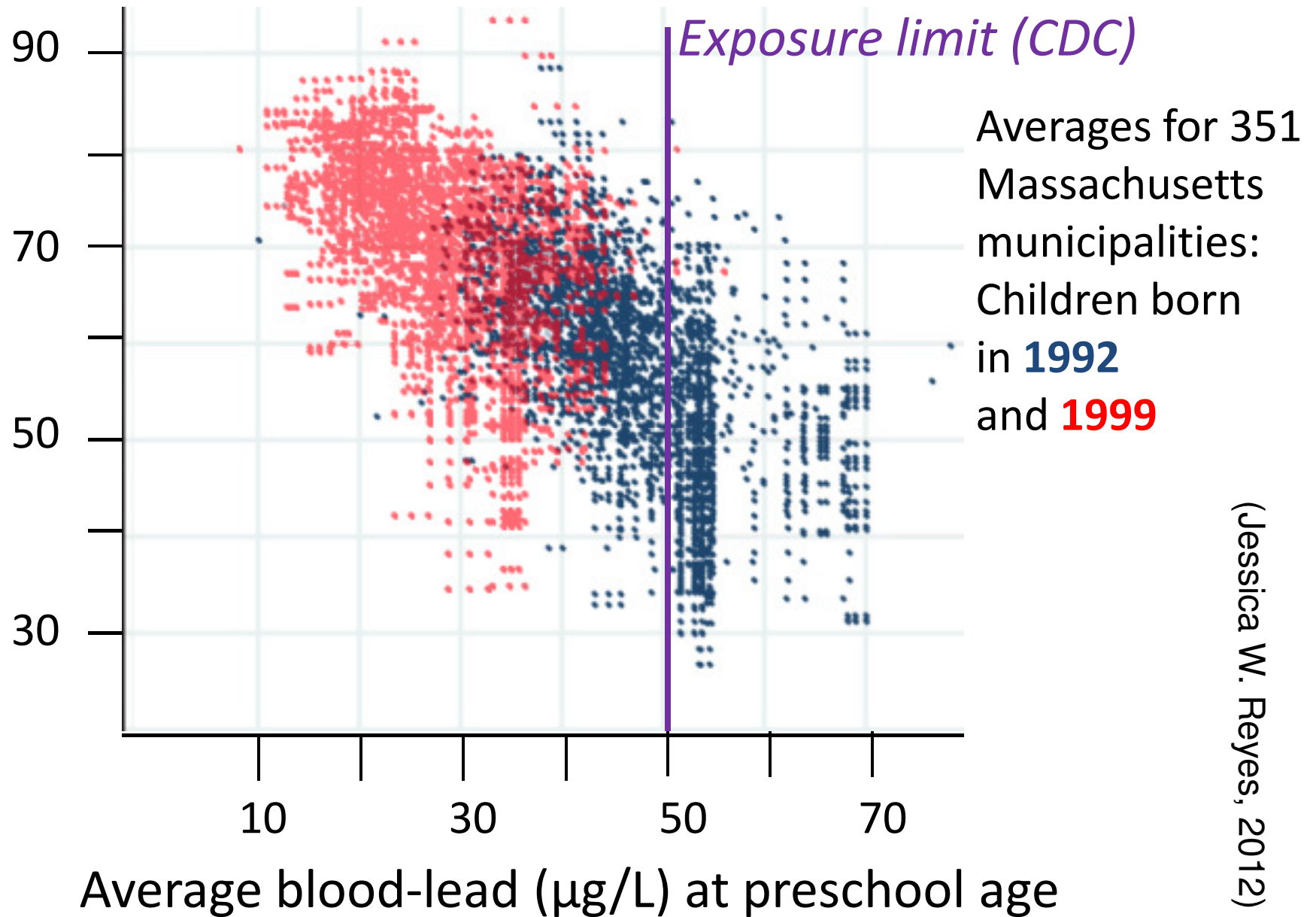


FIG 1: Comparison of the distribution of lesions among the adult (A), non-fetal infantile (B), and fetal infantile (C) Minamata disease. Takeuchi (67), with permission.

From: Choi, BH. *Progress in Neurobiology*, 32: 447-490, 1989.

Percent correct responses on MCAS math test in 4th grade

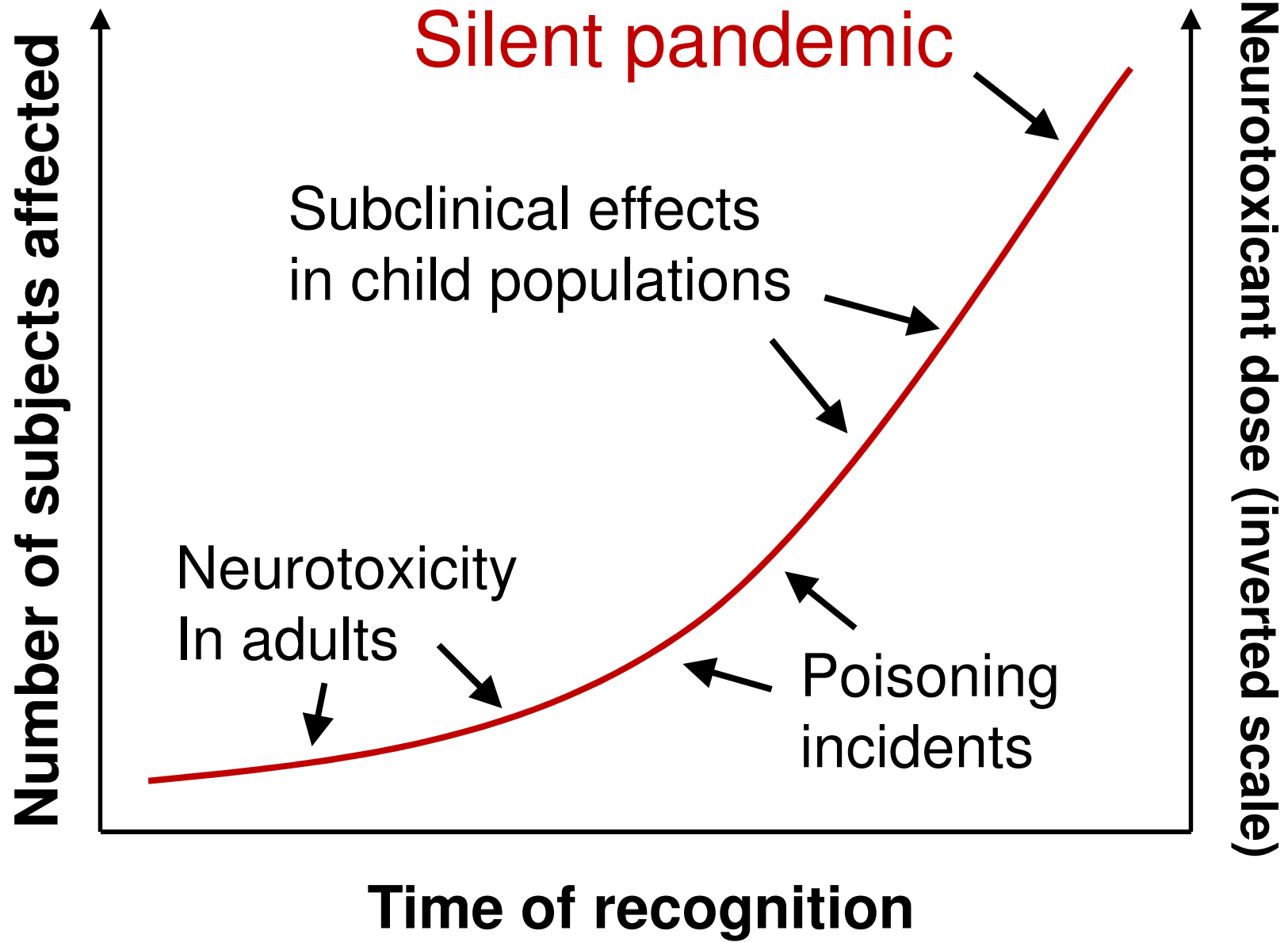


Chemical brain drainers

<i>Chemical group</i>	<i>Known in 2006</i>	<i>Newly identified</i>
Metals/inorganic compounds	Arsenic* Lead* Methylmercury*	Fluoride* Manganese*
Organic solvents	(Ethanol) Toluene*	Tetrachloroethylene*
Pesticides		Chlorpyrifos* DDT/DDE*
Other organic compounds	Polychlorinated biphenyls (PCBs)*	Brominated diphenyl ethers*
Total	6	6

*Endocrine disruptor, according to TEDX

(Grandjean & Landrigan, *Lancet Neurology*, 2014)



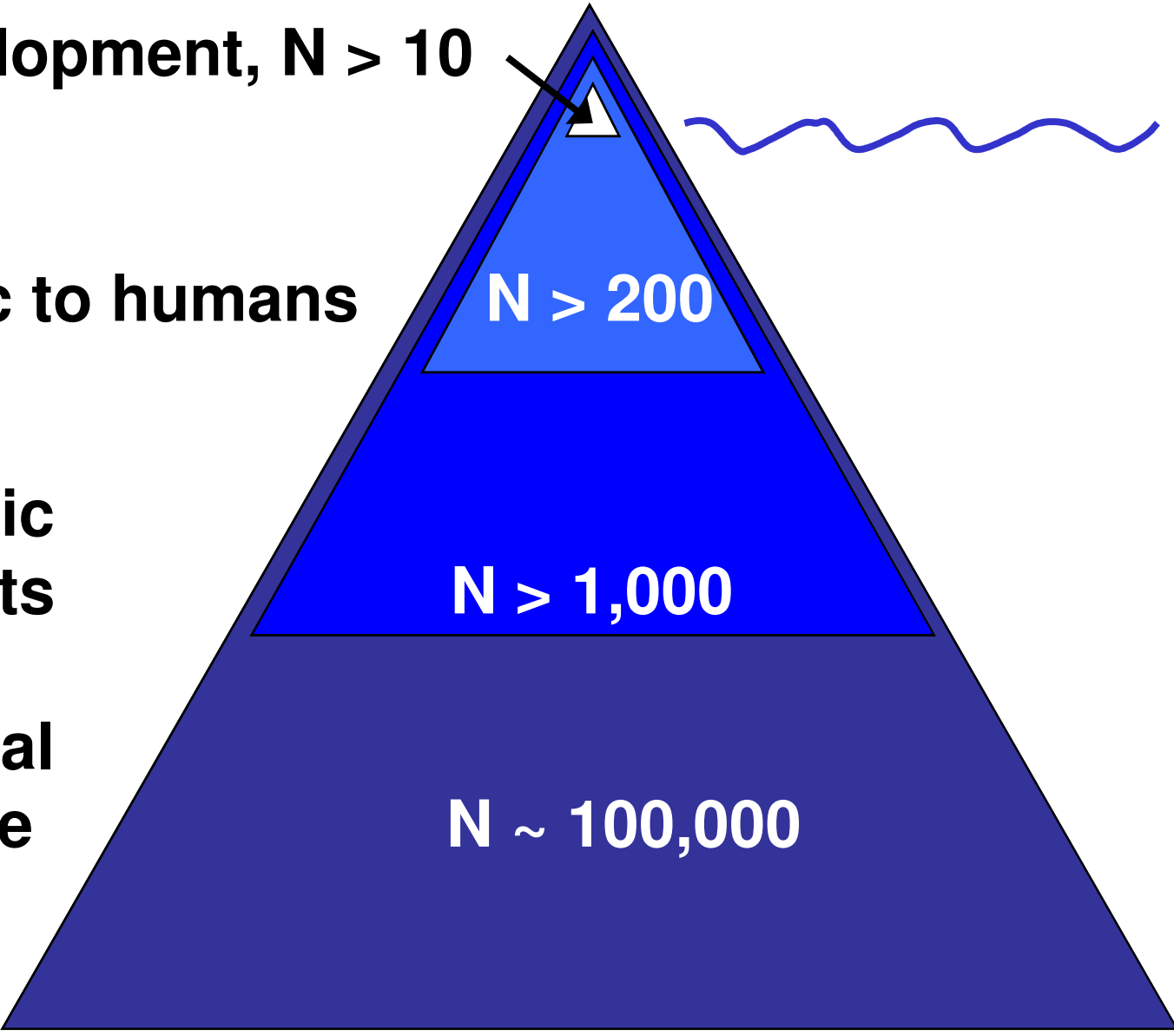
(Grandjean and Landrigan, The Lancet, 2006)

Known neurotoxic to humans during development, $N > 10$

Neurotoxic to humans

Neurotoxic in lab tests

Chemical universe

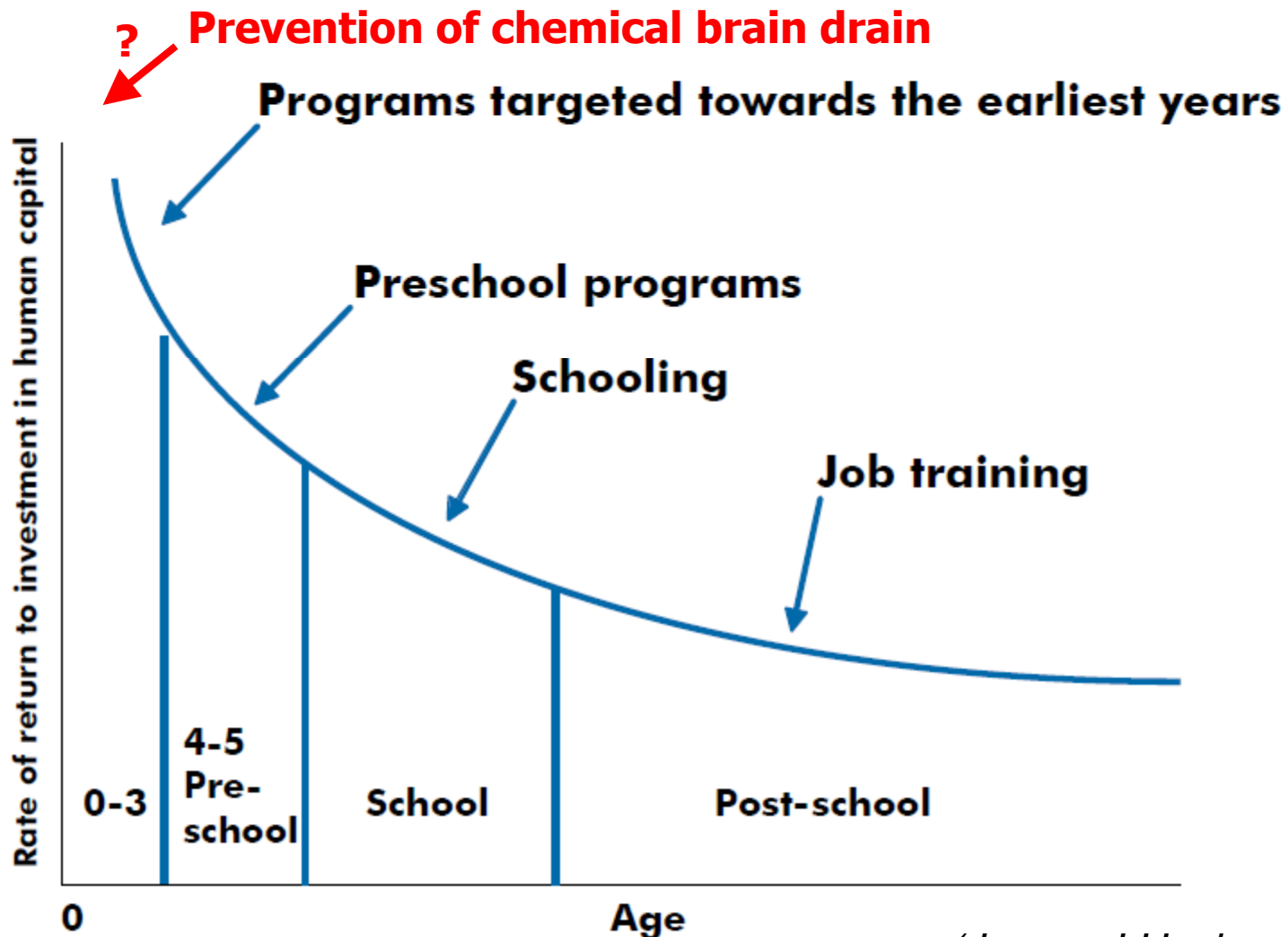


(Updated from Grandjean and Landrigan, The Lancet, 2006)

Returns to a Unit Dollar Invested

11

(a) Return to a unit dollar invested at different ages from the perspective of the beginning of life, assuming one dollar initially invested at each age



(James J Heckman, 2008)

**The goal: Full integrity of the brain
to allow optimal brain functions**

We need it:

The brain
determines
behavior, IQ,
endocrine
functions...

and who we are



What can be done?

- Mothers, consumers can make *choices* to decrease exposures
- An *OECD test protocol* is available to test for developmental neurotoxicity in rodents
- New *cell-based tests* are faster, cheaper
- *Updated regulation of toxic substances*
- Chemicals control needs to include *focus on brain development*
- International *clearinghouse*

www.chemicalbraindrain.info
Facebook: [chemicalbraindrain](https://www.facebook.com/chemicalbraindrain)
Twitter: [ChemBrainDrain](https://twitter.com/ChemBrainDrain)

