



The Ten Toxic Truths and What You Can Do About Them

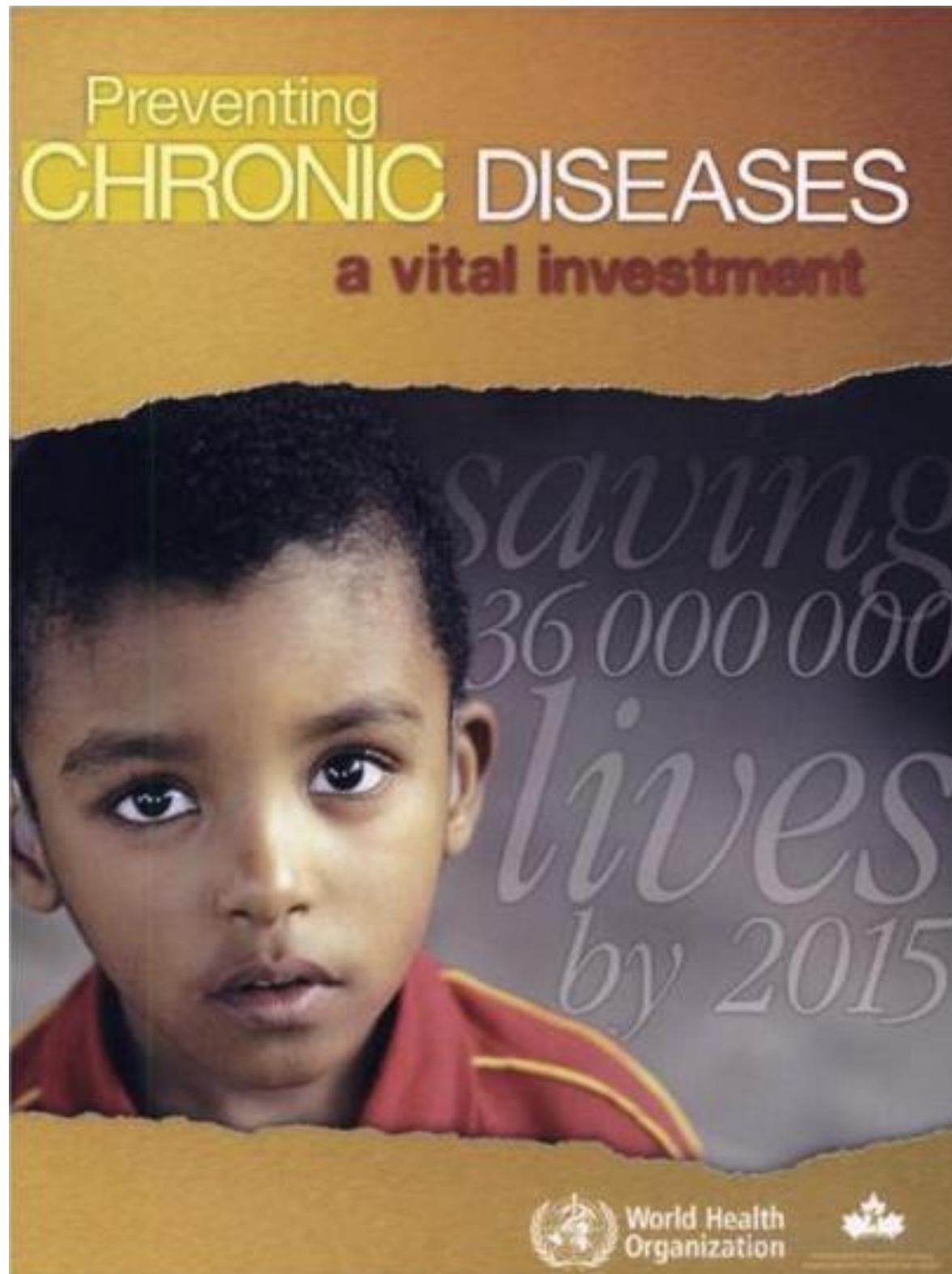
Prof Marc Cohen

MBBS(Hons), PhD_(TCM), PhD_(Elec Eng), B.MedSc(Hons),
FAMAS, FICAE, Dip Ac

Professor of Health Sciences
RMIT University



Chronic disease and lifestyle



>60% of all deaths are caused by lifestyle related chronic diseases.

The main modifiable risk factors for these diseases are:

- physical inactivity
- unhealthy diet
- sugar, salt, fat, alcohol, tobacco
- environmental toxicants

Toxicants and chronic disease



- There is a global epidemic of obesity, diabetes, ADHD, depression and cancer
- Environmental toxicants are rarely considered as a risk factor for chronic disease

WHO -World Cancer Report – Feb 2014



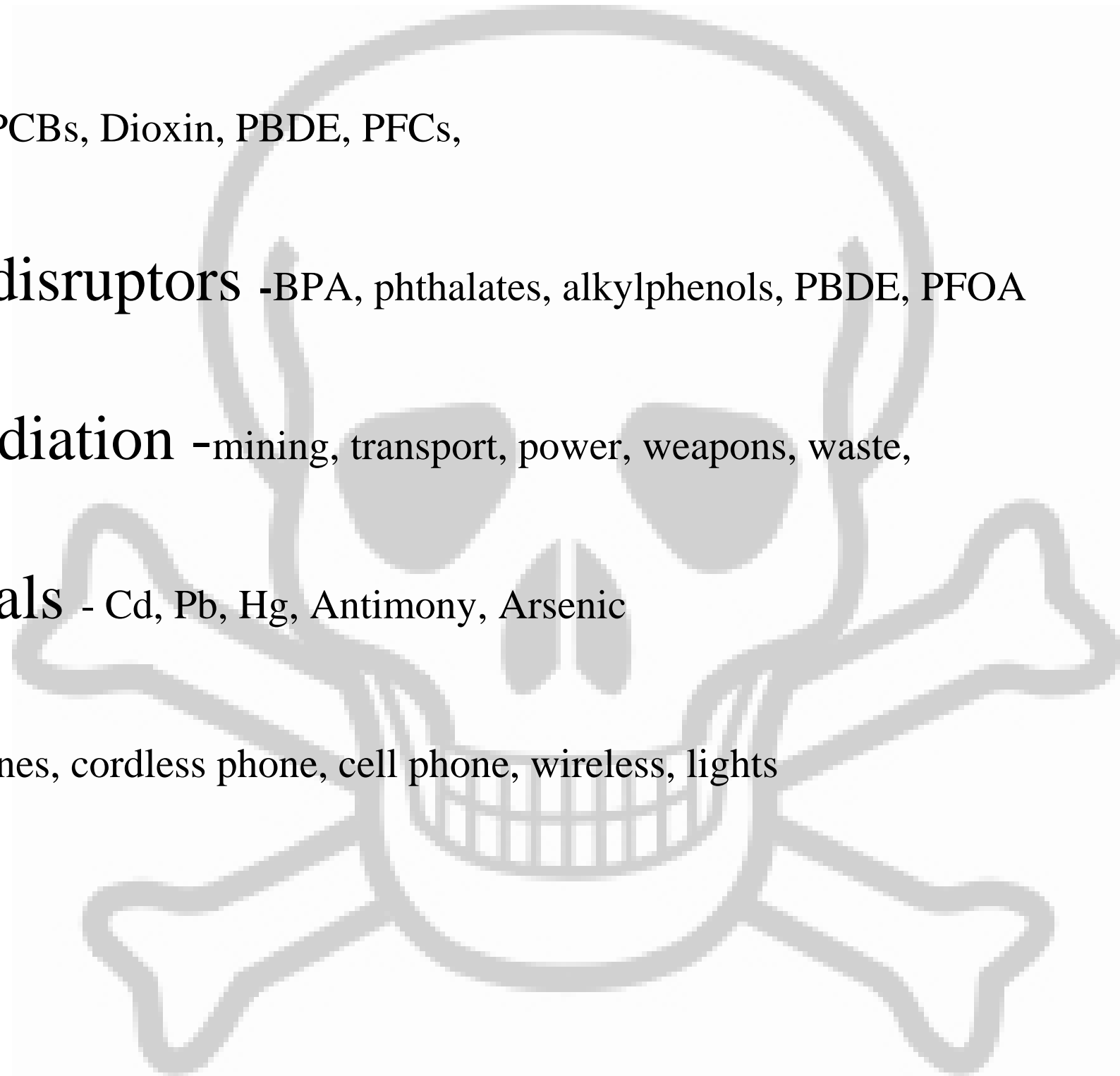
In Australia and around the world, cancer is now the biggest killer.

Cancer prevention plays a critical role in fighting the "tidal wave" of cancer. - Dr Bernard Stewart

Smoking, infections, obesity, alcohol, air pollution and radiation are the major sources of 'preventable' cancer.

Environmental toxicants

- **POPs** -DDT, PCBs, Dioxin, PBDE, PFCs,
- **Endocrine disruptors** -BPA, phthalates, alkylphenols, PBDE, PFOA
- **Nuclear Radiation** -mining, transport, power, weapons, waste,
- **Heavy Metals** - Cd, Pb, Hg, Antimony, Arsenic
- **EMF** -powerlines, cordless phone, cell phone, wireless, lights



The dose makes the poison ... or does it?

“Poison is in everything, and no thing is without poison. The dosage makes it either a poison or a remedy.”

Five Factors Determine Toxicity

- Type
- Dose
- Combination
- Timing
- Individual



Paracelsus 1493-1541

The Ten Toxic Truths

- Everyone is affected
- The full extent is unknown
- Tiny doses can have big effects
- Persistence leads to biomagnification
- Chemical cocktails are synergistic
- Bioaccumulation occurs over the lifespan
- Windows of development are critical
- Effects are epigenetic and trans-generational
- Exposure is unequal, unjust and accidents happen
- Risk is unequal, unjust and greater for the young



1. Toxicants are everywhere

- we are all affected



POPs are found in everyone and everywhere on the planet -in our food, soil, air, water and homes.

Humans and wildlife around the world carry POPs in their bodies at or near levels that can cause injury.

Toxic chemicals are found in all human tissue including cord blood & breastmilk.

Indoor environments are often more contaminated than outdoors

Long Range Environmental Transport

POPs such as DDT are found in all living things from the most arid deserts to the deepest oceans¹

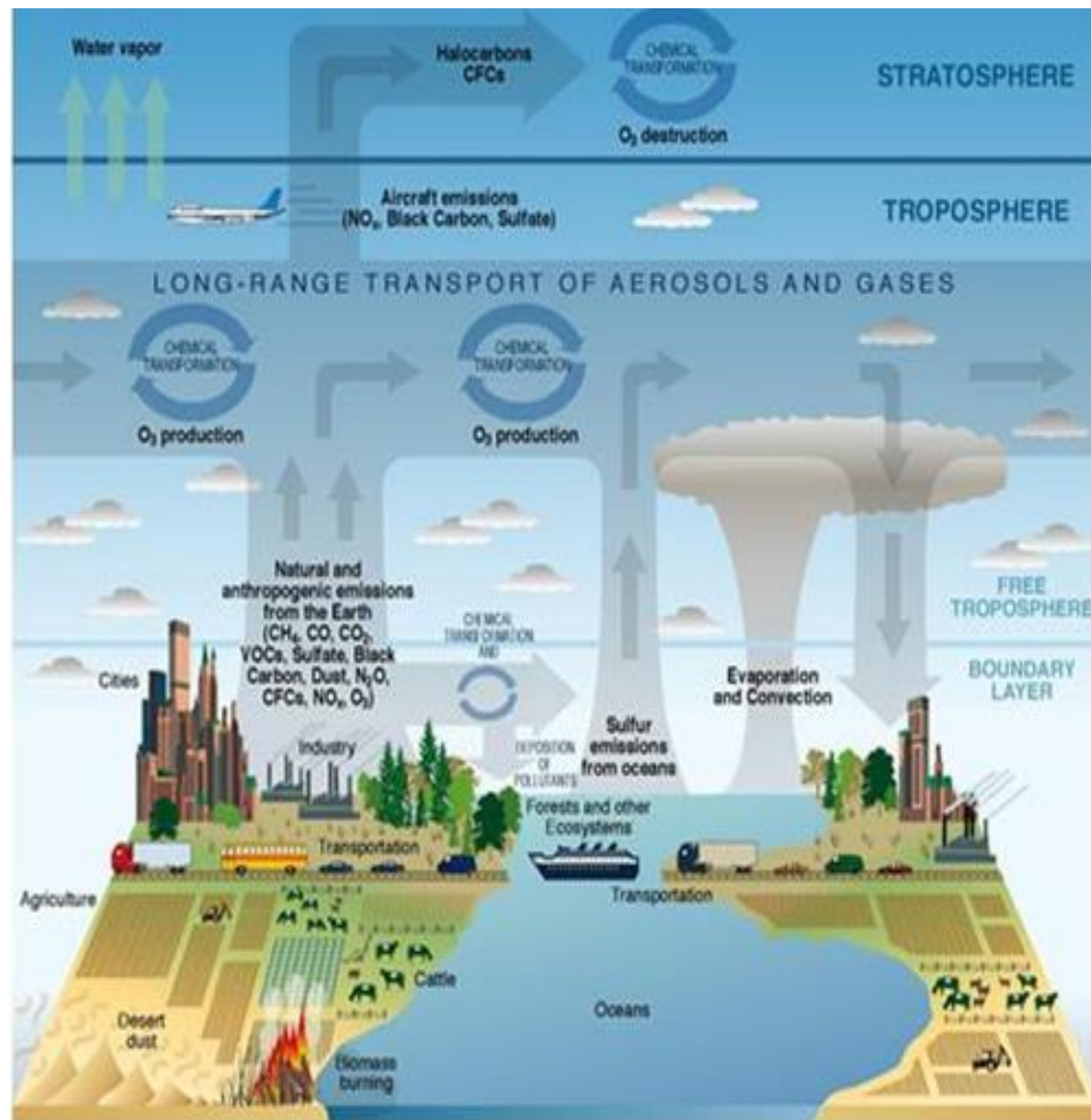
In some areas of the ocean there is 60X more plastic than plankton²

Plastic microparticles in the oceans absorb toxic chemicals and enter the food chain

1) PüssaT (2013) Principles of Food Toxicology, Second Edition CRC Press

2) Are you eating plastic for dinner?

www.facebook.com/video.php?v=601887116607678&fref=nf



Air pollution more deadly than the road toll



- Death from the air pollution exceeds deaths from the road toll and costs Australia \$5.8b¹
- Air pollution boosts potency of airborne allergens²
- Proximity to traffic is a risk factor for heart and lung disease^{3,4}, breast cancer⁵, autism⁶ and poor cognitive function in children⁷



- 1) <http://www.smh.com.au/federal-politics/political-news/air-pollution-takes-toll-on-australian-lives-economy-oecd-report-20140522-38rre.html>
- 2) <http://www.acs.org/content/acs/en/meetings/spring-2015.html>
- 3) http://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0004/52987/Road-Tunnels_TP03_Health_effects_of_traffic_related_air_pollution.pdf
- 4) http://caha.org.au/wp-content/uploads/2012/03/CAHA-Submission-Air-Quality-March-2013_final.pdf
- 5) <http://www.sciencedirect.com/science/article/pii/S0160412014002712>
- 6) <http://archpsyc.jamanetwork.com/article.aspx?articleid=1393589>
- 7) <http://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1001792>

2. The full extent is unknown



toxicants are often invisible, deadly & latent
> 140,000 toxic chemicals are used
commercially >3000 in high volume with
1,500 new chemicals released each year

Many toxic chemicals inadvertently produced
from industrial processes have no use and are
not yet named

Most chemicals are not tested for toxicity

Human biomonitoring studies are limited



2009

Fourth National Report on Human Exposure to Environmental Chemicals



Very few toxic chemicals are routinely tested for in human tissue

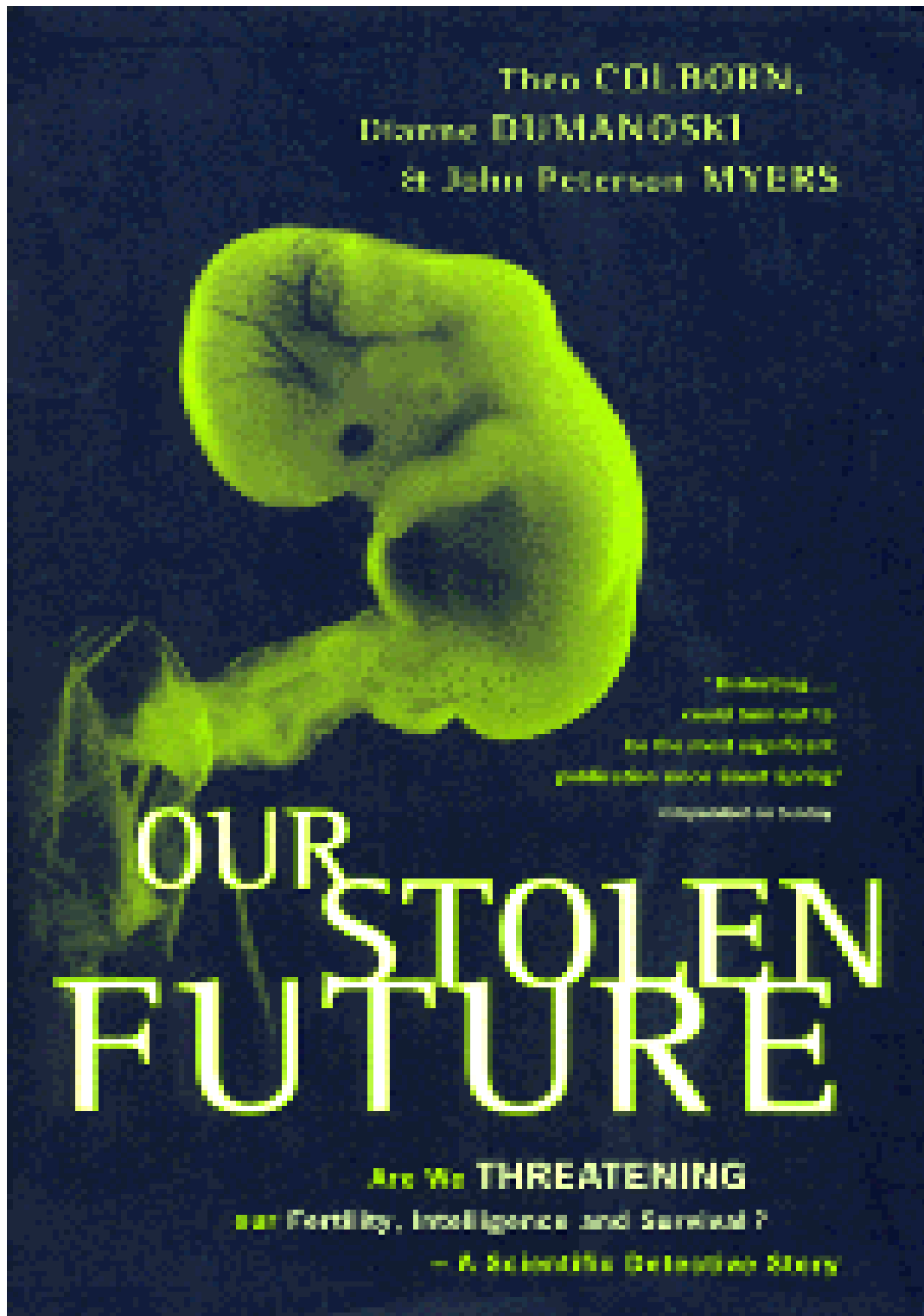
The world's most comprehensive biomonitoring study only examines 212 chemicals

Doctors have no way to assess toxic load and chemical exposure measures are rarely used clinically

<http://www.cdc.gov/exposurereport/>



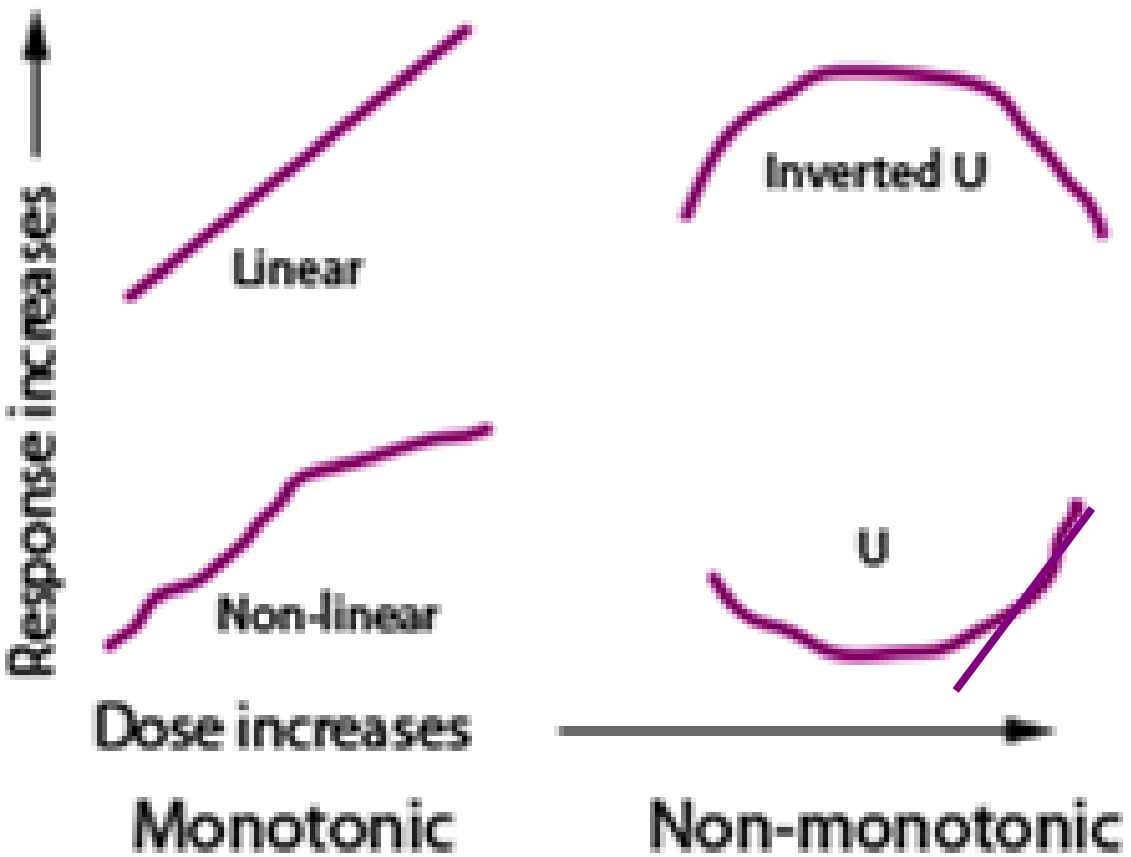
The future is uncertain



Currently used chemicals can impair reproduction, behaviour, intellectual capacity and the ability to resist disease in current and future generations.

“world-wide exposure to endocrine disruption has thrust everyone into a large-scale, unplanned, unintended experiment with health, the outcome of which may not be known for generations.”

3. Tiny doses can cause big effects



Toxicologists traditionally assumed that the dose makes the poison with a monotonic dose response curve.

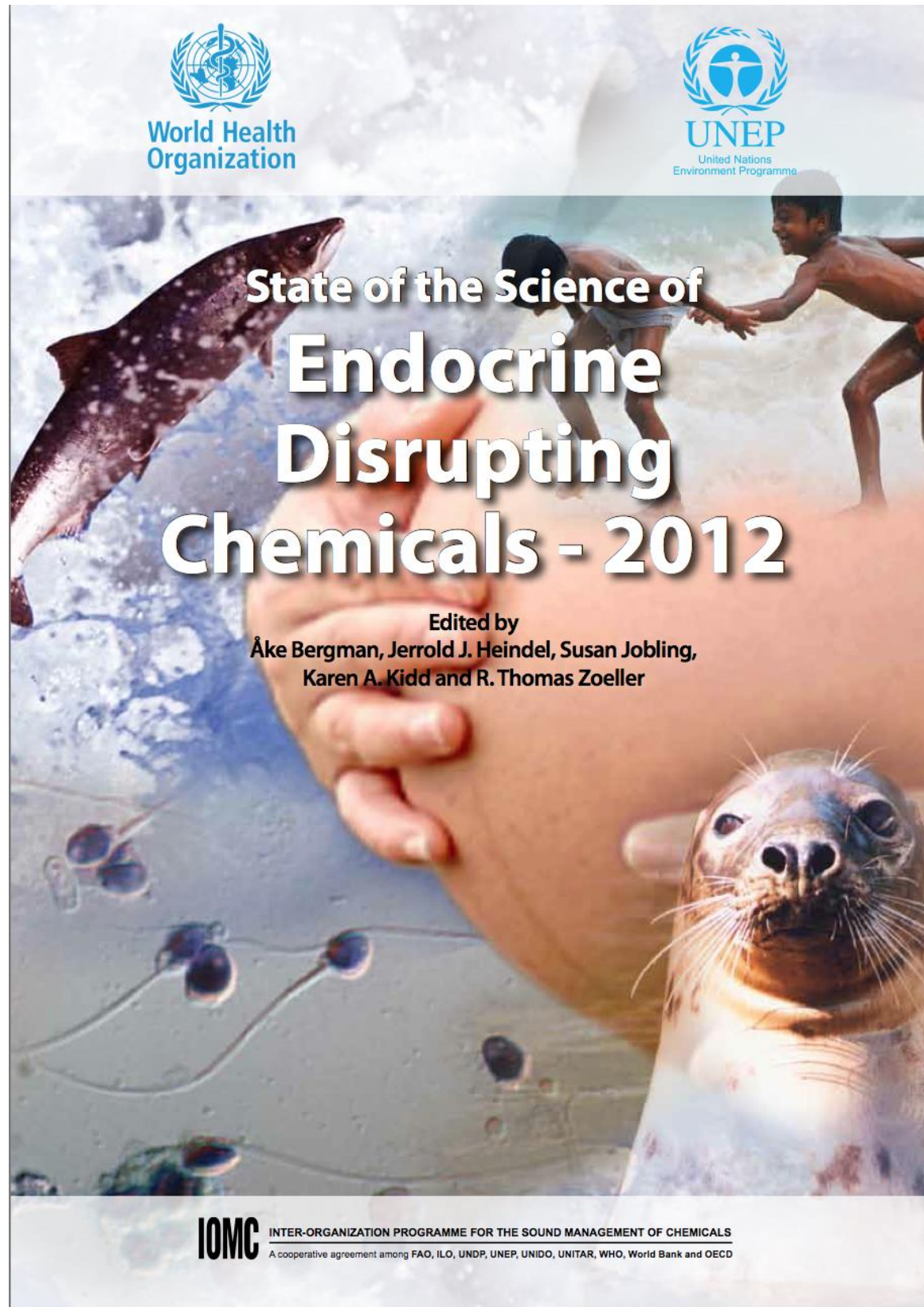
This is the basis for regulation of public safety limits.

Dose response can be non-monotonic

eg. In-utero exposure to DES at 100 ppb leads to scrawny adult mice while exposure to 1ppb, causes grotesque obesity.



WHO UNEP Report on Endocrine Disrupting Chemicals



EDCs found in pesticides, electronics, personal care products, cosmetics and food are partly to blame for a global increase in

- obesity,
- birth deformities,
- cancers,
- psychiatric diseases,
- ADHD,
- neurodevelopmental problems in children etc.

Current findings may be “*the tip of the iceberg*”

EDC exposure and disease development

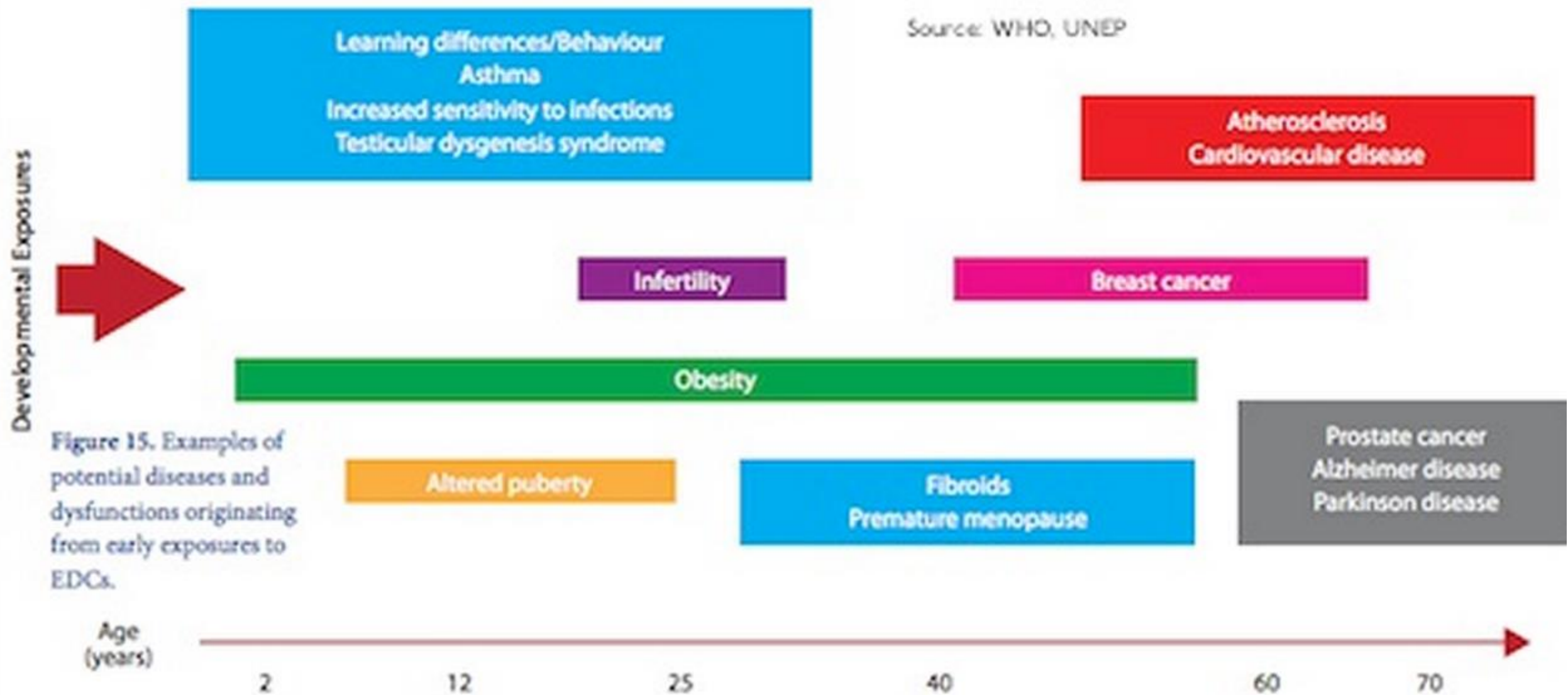


Figure 15. Examples of potential diseases and dysfunctions originating from early exposures to EDCs.

4. Persistence leads to biomagnification

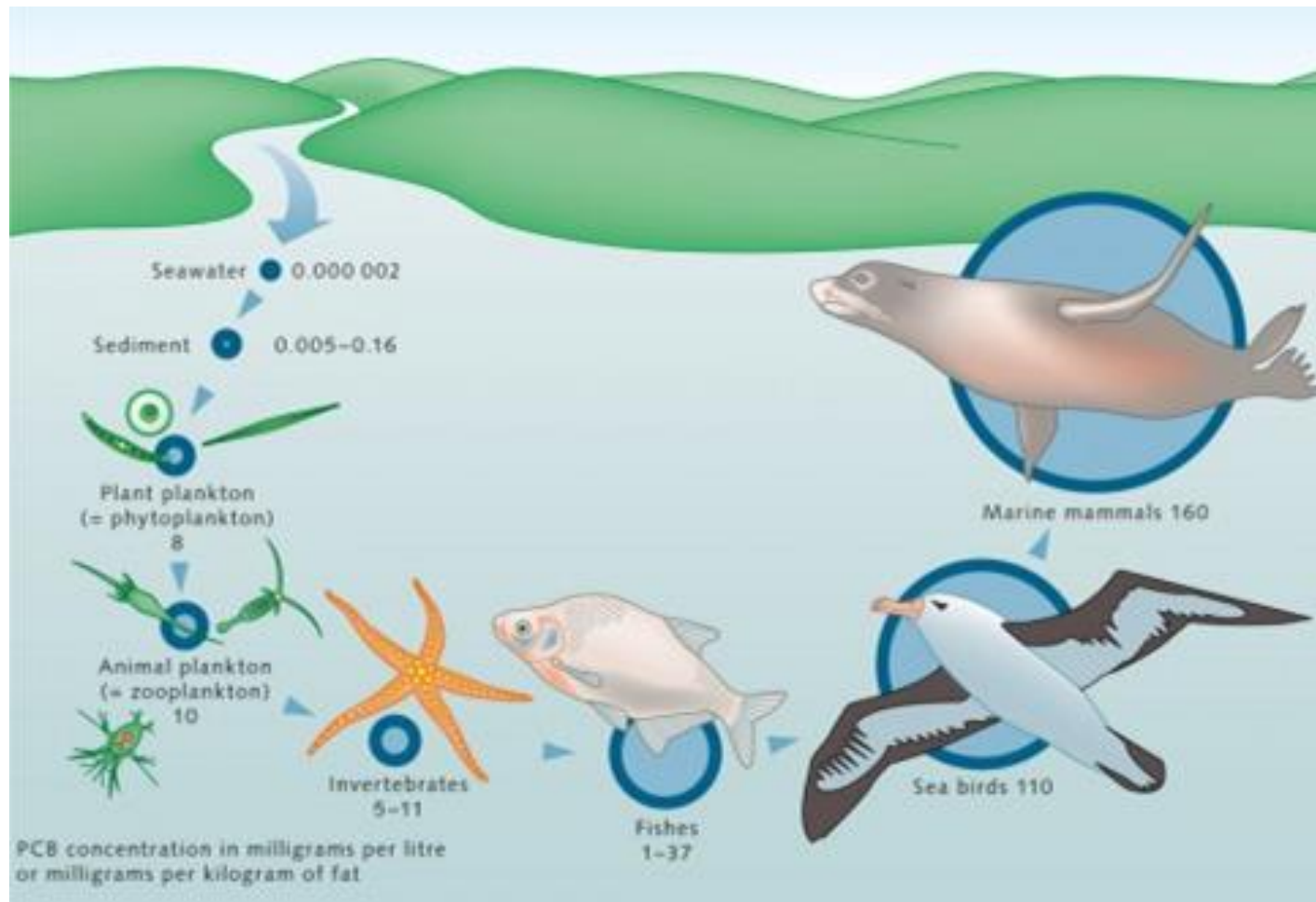


Image source <http://worldoceanreview.com/en/wor-1/pollution/organic-pollutants/>

- Persistent organic pollutants such as DDT & PCB persist for years in the environment
- They are stored in fatty tissue and biomagnify up to 10 million times through the food chain

Stockholm Convention on POPs



Action from 2004 to reduce global exposure to POPs that:

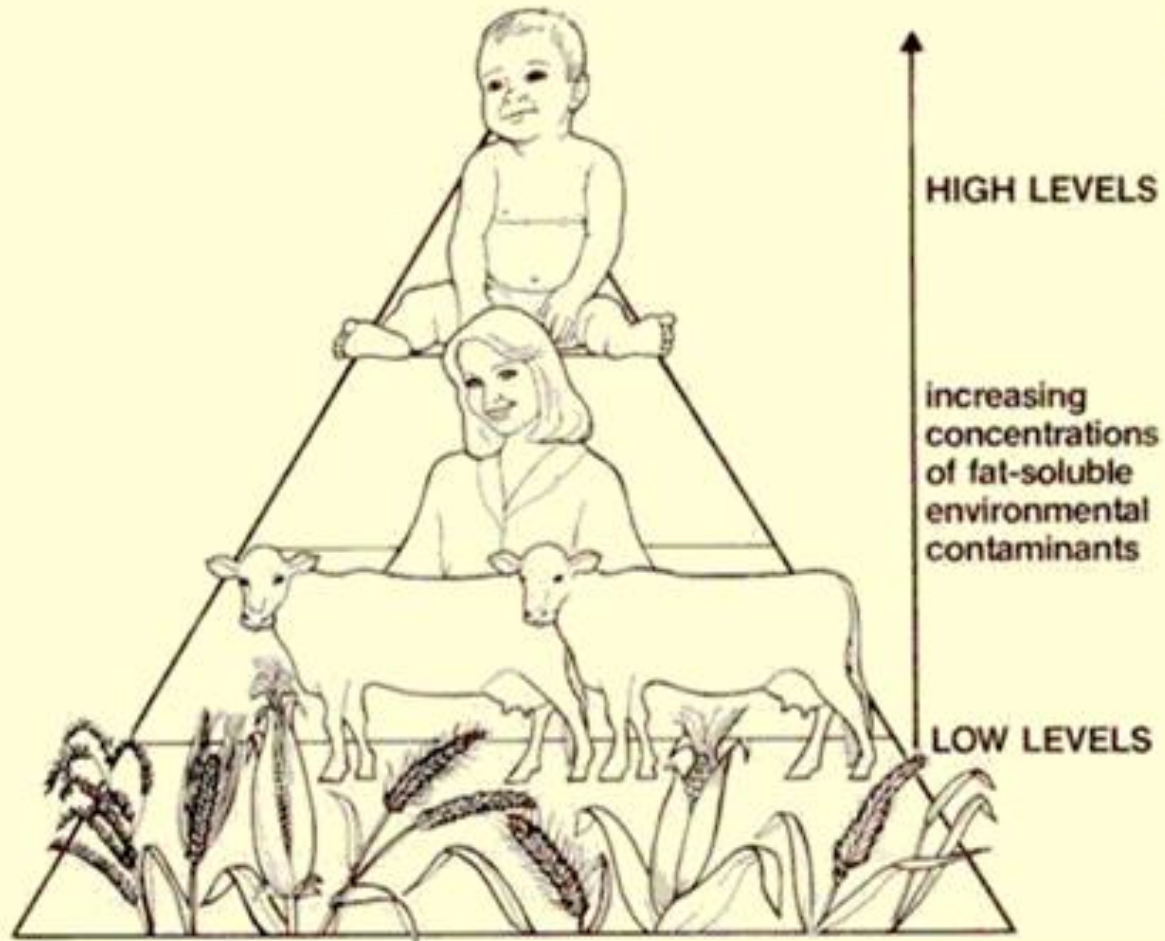
- Long Range Environment Transport
- Persist in the environment
- Bioaccumulate up the food chain
- Toxic to humans and environment

Dirty Dozen

- | | | | |
|----|-------------------------|-----|------------------|
| 1. | Aldrin | 7. | Mirex |
| 2. | Chlordane | 8. | Toxaphene |
| 3. | Dieldrin | 9. | DDT |
| 4. | Endrin | 10. | Dioxins |
| 5. | Heptachlor | 11. | Furans |
| 6. | Hexachlorobenzene (HCB) | 12. | PCB _s |

Top of the food chain

<http://permaculturenews.org/2008/08/13/pesticides-and-you/>



- All human breast milk samples are contaminated with the first child getting a greater toxic load
- Despite its toxicity, the benefits of breastfeeding far exceed the risks
- Sea mammals can be so polluted their carcasses must be treated as toxic waste

Whale ear-wax shows birth to death exposure and may be used to monitor ocean POP levels



<http://www.pnas.org/content/110/42/16922.abstract>

Image source www.anon.org/images/deadWhale.jpg

© Prof Marc Cohen

5. Chemicals cocktails are synergistic

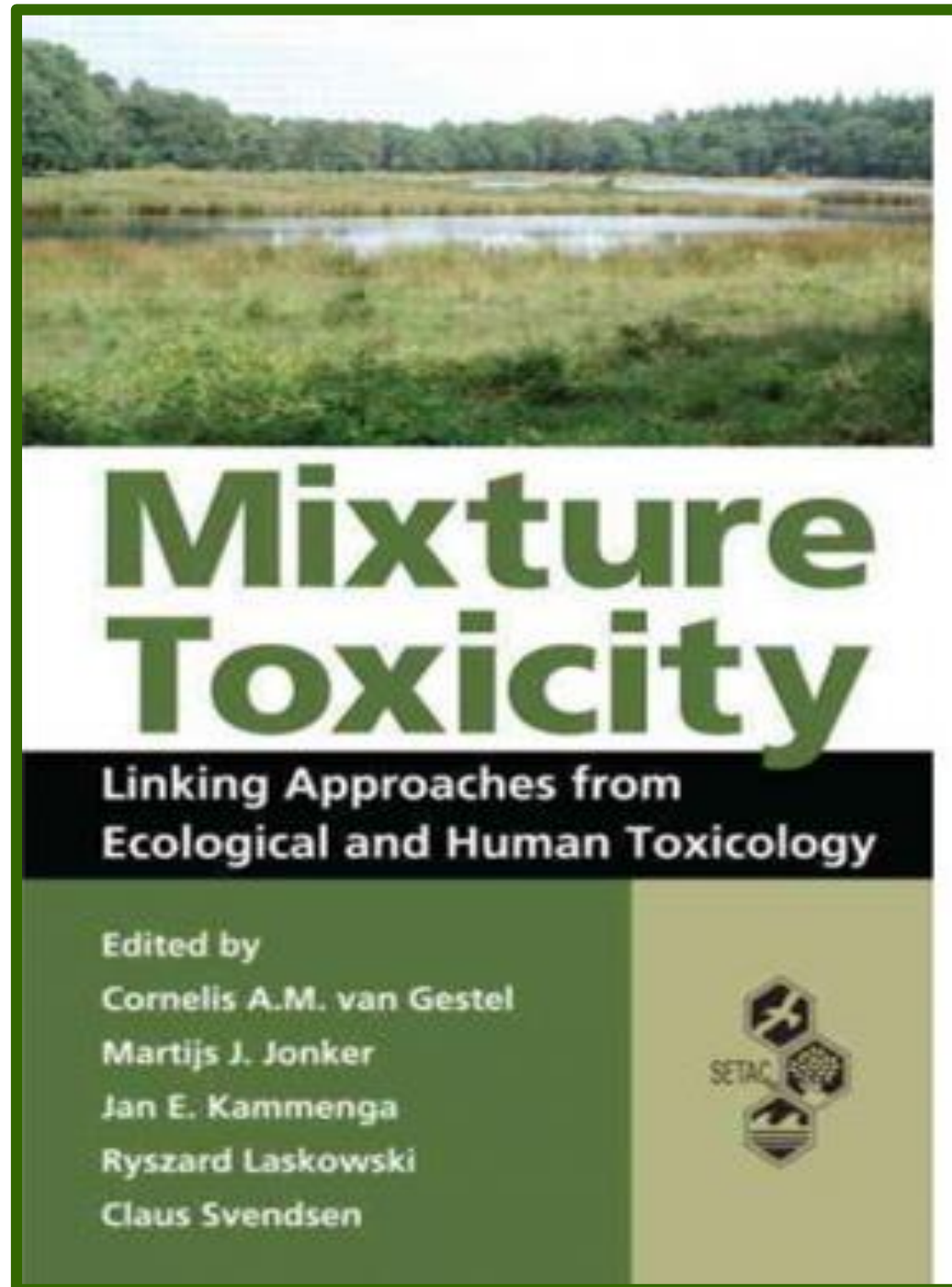


Exposure to a mixture of chemicals is far more harmful than exposure to individual chemicals . . .

. . . even when the level of each contaminant in the mixture causes no effect by itself.

toxicants are tested for safety individually . . . if they are tested at all

Mixture toxicity – combination effects are real



State of the Art Report on Mixture Toxicity
Final Report Executive Summary 22 Dec 2009



“something from nothing”
- dose (concentration) addition

“strong evidence that mixture effects may arise when several chemicals are combined at doses or concentrations around, or below, points of departure [zero effect levels]”

Pesticides – far more toxic than their active ingredients



- Toxicity testing for pesticide ADIs is only done on so-called ‘*active ingredients*’
- Pesticide formulations contain so-called ‘*inert*’ adjuvants that are undisclosed and confidential
- Adjuvants act as surfactants and cell penetrants that can increase toxicity by over 1000 x
- Tests on human placental and liver cells found formulations were 100s of times more toxic than the active ingredient with Roundup being 125x more toxic than glyphosate.

6. Bioaccumulation over the lifespan



Fat soluble toxicants are not usually excreted and accumulate in fatty tissue over an individual lifespan.

Fatty tissue such as breast, prostate, and bone marrow is the source of many cancers.

This body burden of toxicants is passed onto the next generation in-utero targeting the fetal brain.

Kids toxic start to life - Prepolluted



287 toxicants have been detected in cord blood. Of these 180 are known carcinogens, 208 cause birth defects in animals and 217 are toxic to the nervous system and brain

www.ewg.org/reports/bodyburden2/execsumm.php
environmentaldefence.ca/prepolluted



A Victorian study of breast milk found that infants are regularly exposed to several pesticides at levels greater than the ADI.

Quinsey et al. Food Chem Toxic 1995;33(1):49-56.

Pseudo POPs and chronic disease

Many EDCs are ingested continually throughout the lifespan making them pseudo-persistent and contributing to chronic disease risk.

Higher BPA levels are associated with clinically abnormal liver enzymes,¹ cardiovascular disease,^{1,2} and diabetes^{1,3}



1. Lang, et al.1..Does early-life exposure to organophosphate insecticides lead to prediabetes and obesity? *Reproductive Toxicology*, 2011. 31(3): p. 297-301.
2. Lang, et al., Association of urinary bisphenolA concentration with medical disorders and laboratory abnormalities in adults. *JAMA*, 2008.300(11)
- 3.Melzer, et al., Urinary Bisphenol: A Concentration and Risk of Future Coronary Artery Disease in Apparently Healthy Men and Women. *Circulation*, 2012.

7. Windows of development are critical



Thalidomide reduces morning sickness in pregnant women but causes phocomelia in infants



Prenatal exposure to OP pesticides and phthalates affects intellectual development in later life¹⁻³

1. Bouchard et al. (2011). "Prenatal exposure to organophosphate pesticides and IQ in 7-year-old children." *Environ Health Perspect* **119**(8).
2. Rauh et al. (2011). "Seven-Year Neurodevelopmental Scores and Prenatal Exposure to Chlorpyrifos, a Common Agricultural Pesticide" *Environ Health Perspect*. **119**(8): 1196-1201.
3. Whyatt et al. (2011) "Maternal Prenatal Urinary Phthalate Metabolite Concentrations and Child Mental, Psychomotor and Behavioral Development at Age Three Years." *Environmental Health Perspectives*, 1-29.

Neurodevelopmental toxicants

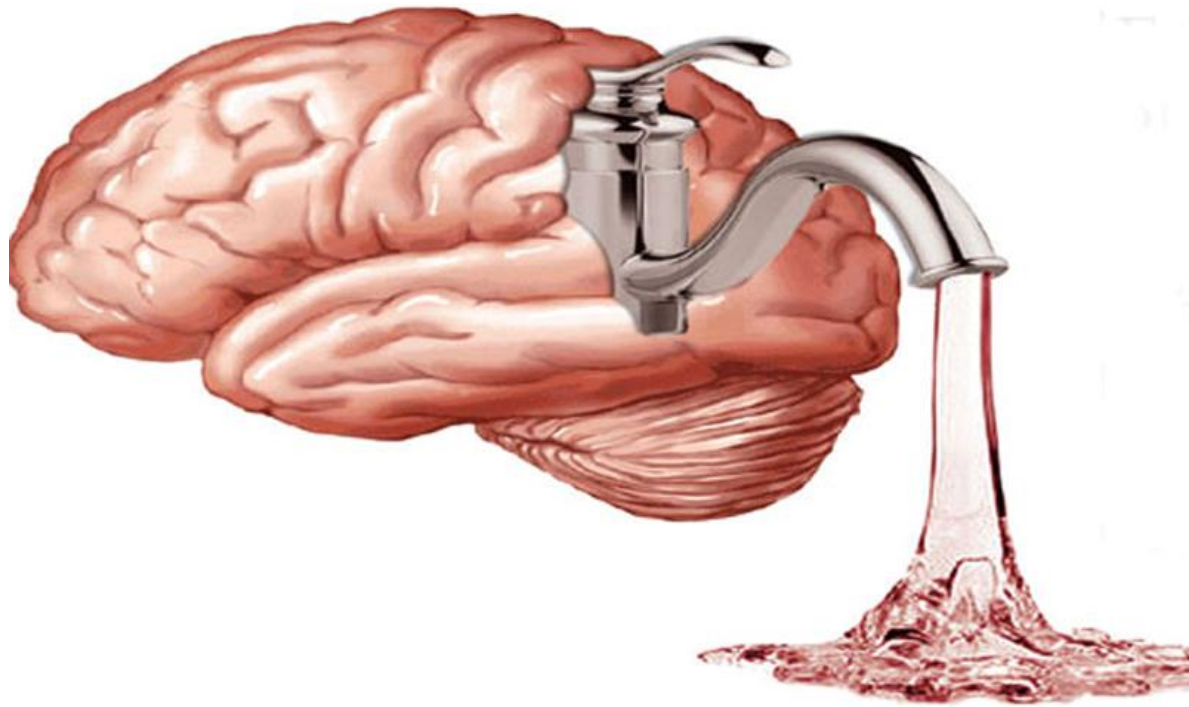


Image source www.thegeminigeek.com/wp-content/uploads/2009/06/brain-drain.jpg

The world is facing a “*silent pandemic*” of “*chemical brain drain*” with increasing rates of neurodevelopmental disabilities, including autism, attention-deficit hyperactivity disorder, dyslexia, and other cognitive impairments

Known neurodevelopmental toxicants:

- Lead
- Methylmercury
- PCBs
- Arsenic
- Toluene
- Manganese
- Fluoride
- Chlorpyrifos
- DDT
- Tetrachloroethylene
- PBDEs



Dr. Philippe Grandjean



Dr Philip Landrigan

Early exposure leads to latent chronic disease

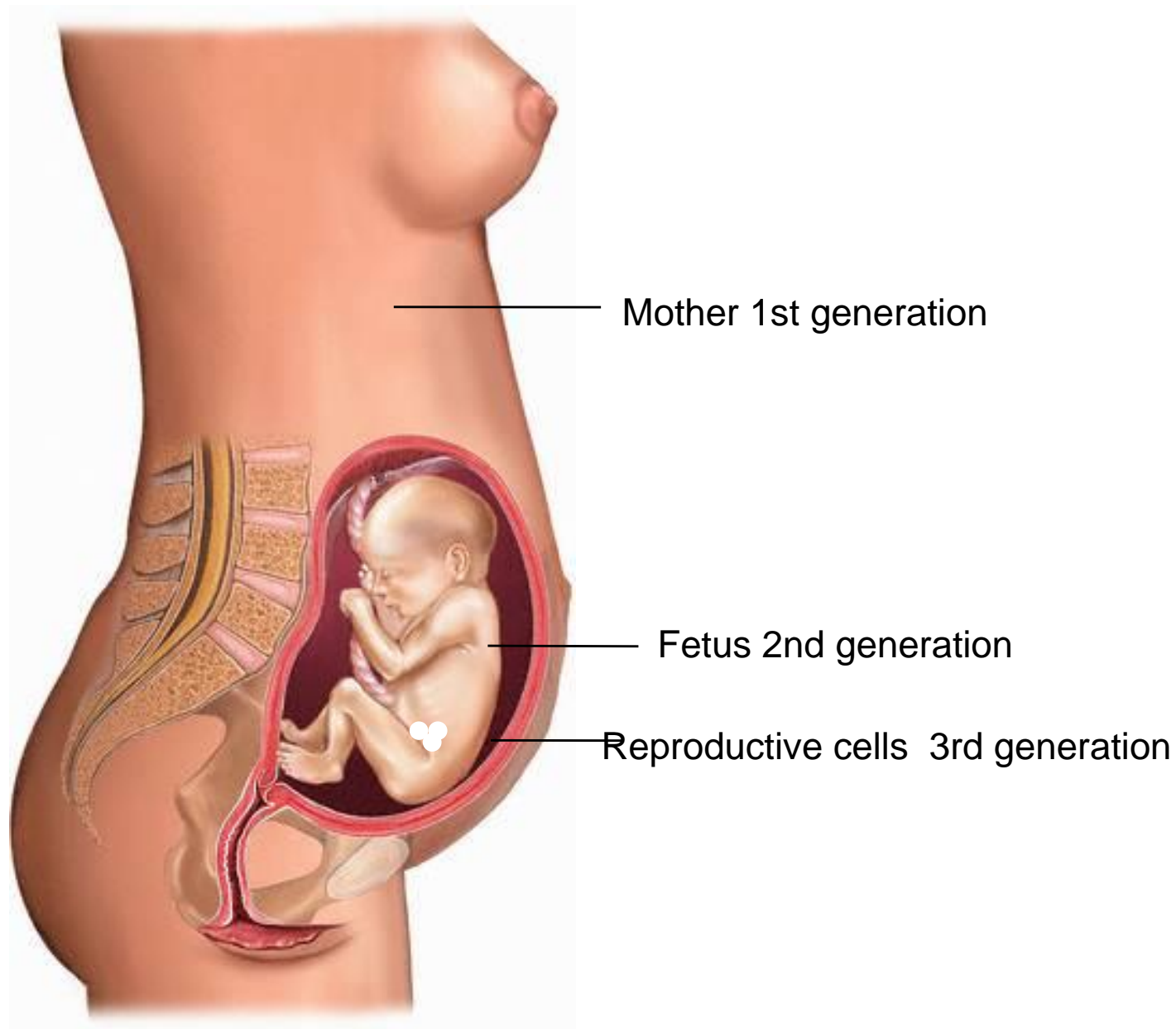
Effects of EDCs are often irreversible with effects not evident till later in life

OP exposure during critical periods can alter metabolic function and foster dietary choices favouring high fat intake and development of metabolic syndrome, diabetes and obesity [1]



www.stuffedandstarved.org

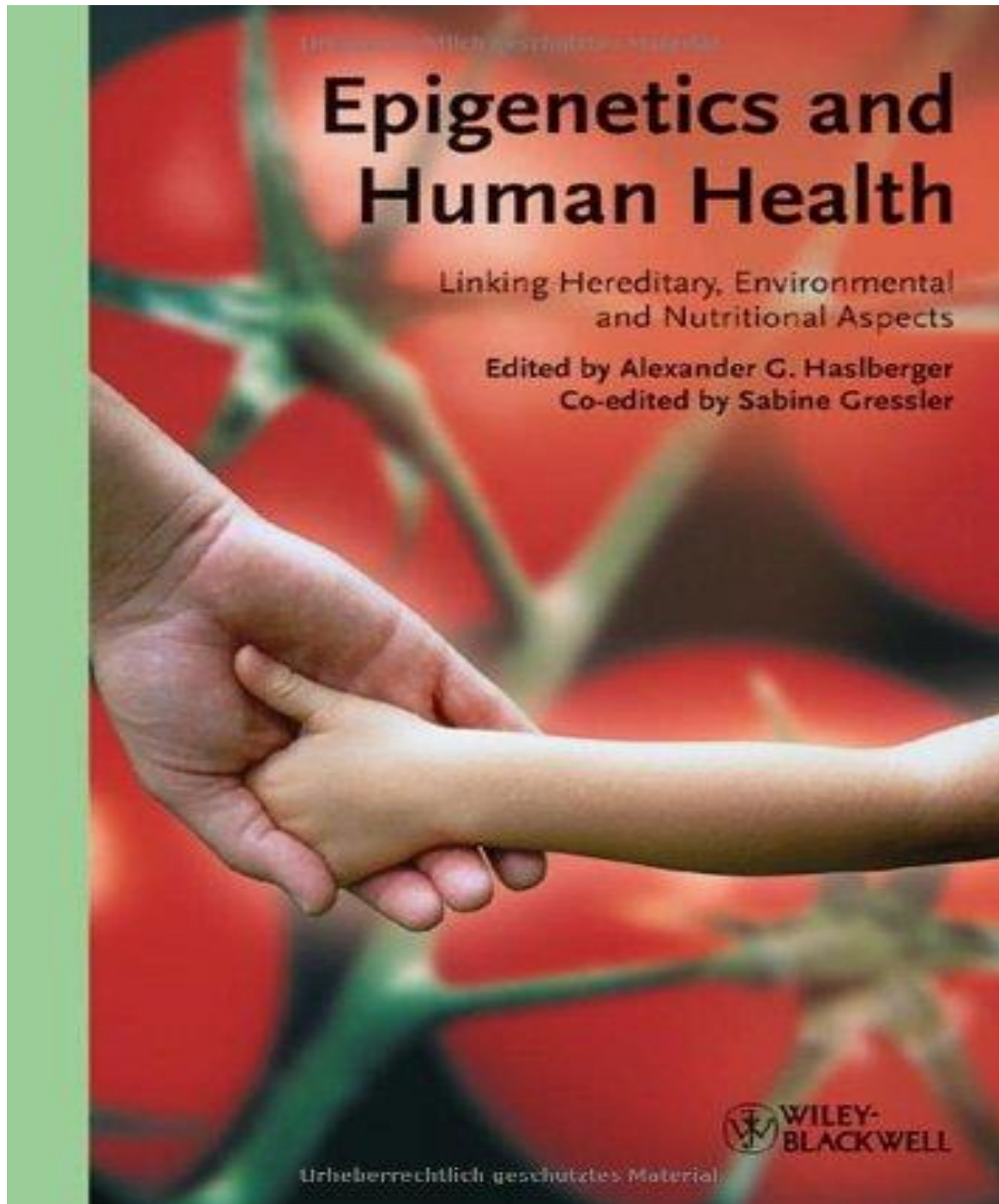
8. Effects are epigenetic & transgenerational



Maternal exposure affects the unborn child and future grandchildren (and possibly great grandchildren)

Environmental Epigenetics:

A new paradigm for evolution in a contaminated world



Ancestral exposure to an endocrine disruptor (three generations previously) influences how adult males' descendants respond to stress experienced during earlier adolescence.

Epigenetic effects of environmental contaminants are transforming evolutionary -- not just physiological and ecological -- trajectories

Effects are robust, observed at the level of the transcriptome, morphology, physiology, metabolism in critical brain nuclei, and behavior.

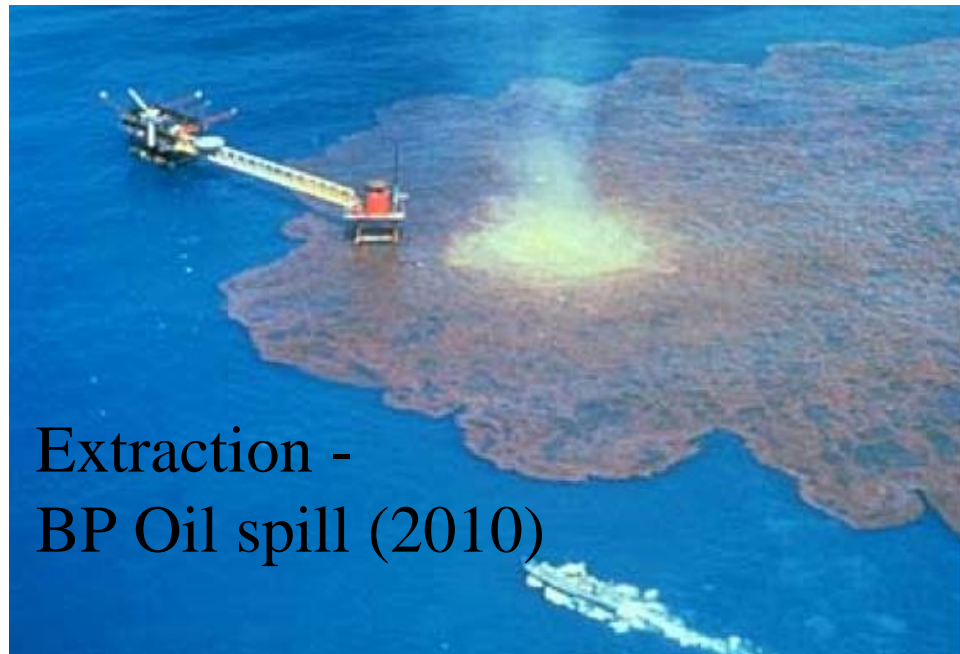
9. Exposure is unequal and unjust



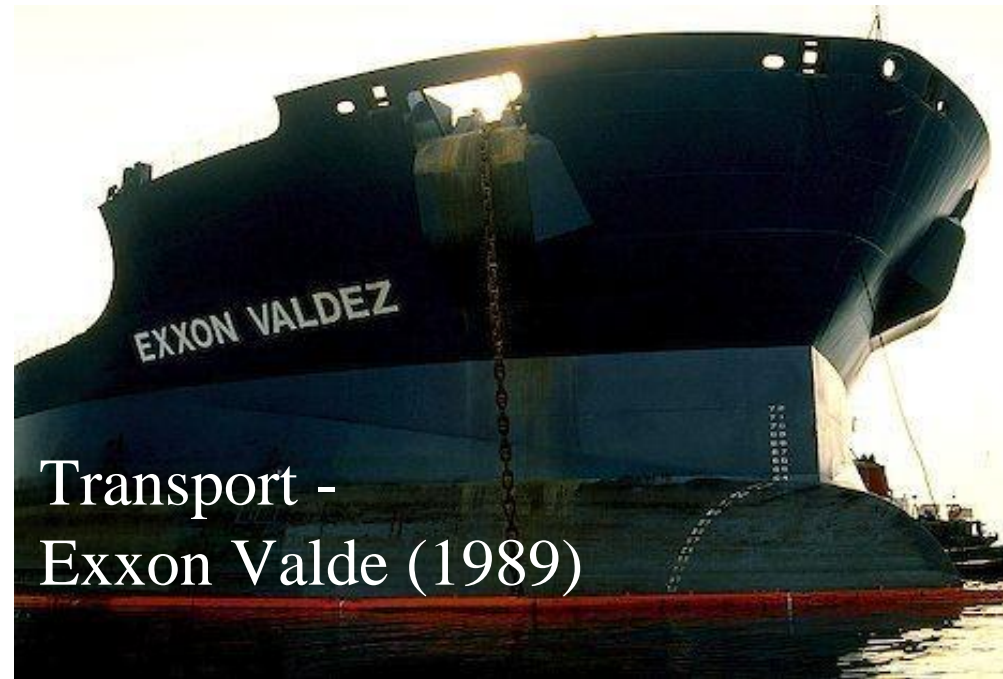
toxicant exposure varies with:

- Public policy
- Demographics -age, socioeconomics, education, occupation
- Location
- Consumption / Usage
- Mitigation measures

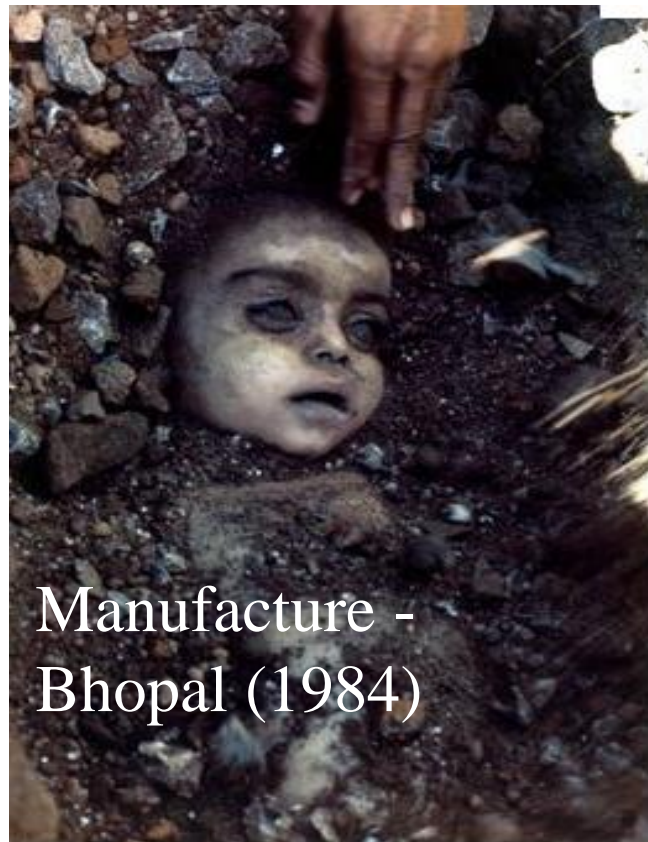
Accidents happen at every stage



Extraction -
BP Oil spill (2010)



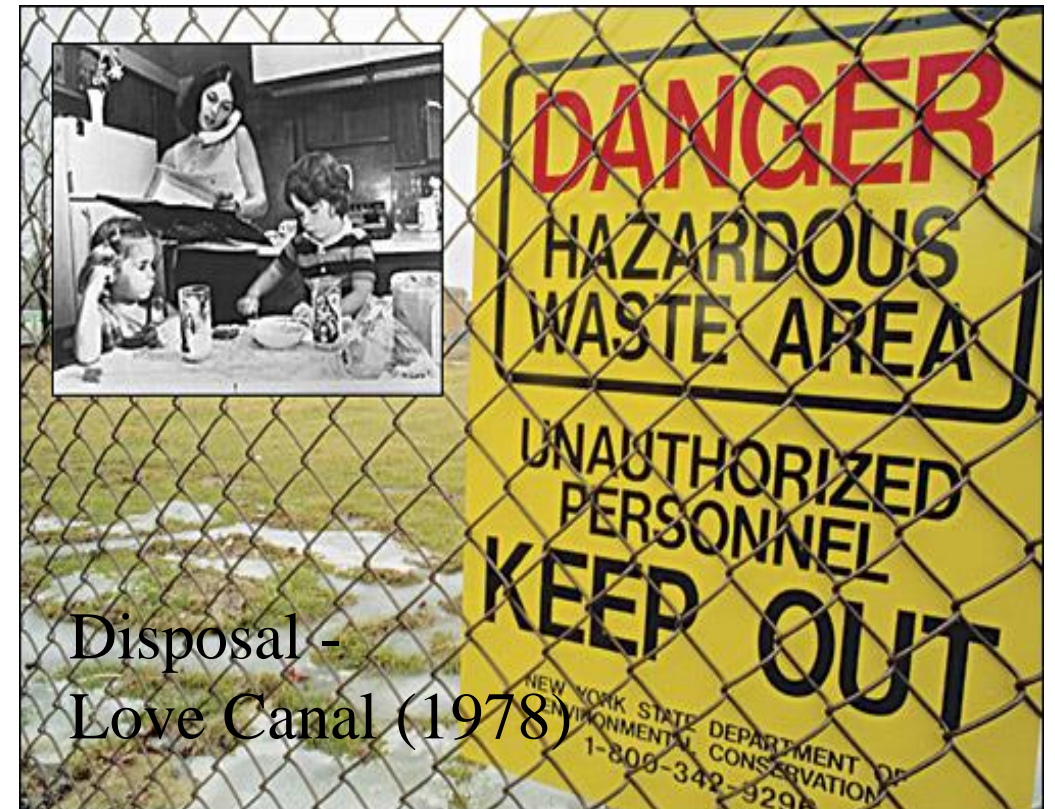
Transport -
Exxon Valde (1989)



Manufacture -
Bhopal (1984)



Use -
Chernobl (1986) &
Fukishima (2011)



Disposal -
Love Canal (1978)

10. Risk is unequal and greatest for the young

A Generation in Jeopardy

**How pesticides are undermining
our children's health & intelligence**



Compared to adults kids have:

- Higher food, fluid and air intake /kg
- Higher absorption and metabolic rate
- Immature immune and detox systems
- More exposure to the ground
- More hand to mouth behaviour
- Longer latency period to develop disease

Pesticide Action Network

Pesticide Residues in Australian Children



- Australian preschool children were found to have widespread chronic exposure to multiple neurotoxic pesticide residues
- These levels are higher than in the US or Germany
- The levels of exposure of the Australian adult population is unknown and unmonitored

Fossil food fuels the problem



Food is a major source of ingested toxicants

It takes an ~7 -10 calories of input fossil fuel to produce 1 calorie of food



As much as 40% of energy used for food goes towards the production of chemical fertilizers and pesticides

<http://www.theguardian.com/environment/2012/sep/06/pesticides-hazardous-chemicals-un>

Heller, Martin C., and Gregory A. Keoleian. Life Cycle-Based Sustainability Indicators for Assessment of the US Food System Ann Arbor, MI: Center for Sustainable Systems, University of Michigan, 2000: 42.

Glyphosate



- The largest selling agri-chemical on the planet with use predicted to double over the next 5 years¹
- Acts as a chelator, antibiotic, inhibits CYP P450 enzymes²⁻³ probable carcinogen⁴
- Recently found in human breast milk⁵ yet levels in Australians is unknown and unmonitored
- 125x more toxic when formulated as Roundup⁶
- Implicated in fatal kidney disease in rural farmers⁷
- Implicated in celiac disease and gluten intolerance²

1. Global Industry Analysts, I. (2011). Glyphosate: A global strategic business report.
2. Samsel & Seneff (2013). "Glyphosate, pathways to modern diseases II: Celiac sprue and gluten intolerance " *Interdiscip Toxicol* 6(4): 159-184.
3. Samsel & Seneff (2013). "Glyphosate's Suppression of Cytochrome P450 Enzymes and Amino Acid Biosynthesis by the Gut Microbiome: Pathways to Modern Diseases." *Entropy* 15: 1416-1463
4. Guyton (2015) March 20 www.thelancet.com/journals/lanonc/article/PIIS1470-2045%2815%2970134-8/fulltext
5. <http://sustainablepulse.com/2014/04/06/worlds-number-1-herbicide-discovered-u-s-mothers-breast-milk/#.U21lhK2Sxbw>
6. Mesnage, R., Defarge, N., Spiroux de Vendômois, J., & Séralini, G.-E. (2014). "Major pesticides are more toxic to human cells than their declared active principles. ." *BioMed Research International*: 1-15.
7. Jayasumana, et a. (2104). "Glyphosate, Hard Water and Nephrotoxic Metals: Are They the Culprits Behind the Epidemic of Chronic Kidney Disease of Unknown Etiology in Sri Lanka?" *Int. J. Environ. Res. Public Health* 11(2): 2125-2147.

Organophosphate Pesticides



Neurotoxins based on chemical warfare agents

Less persistent but more acutely toxic than DDT

Fatal in high doses - cause ~ 300,000 deaths/yr

Higher levels correlate with ADHD ¹

Perinatal exposure is associated with

- ADHD and reduced IQ at age 3-7 ²⁻⁴
- Obesity, metabolic syndrome and diabetes in offspring ⁵

1. Bouchard, M., et al (2010). "Attention-Deficit/Hyperactivity Disorder and Urinary Metabolites of Organophosphate Pesticides." *Paediatrics* 125(6): e1270-e1277.

2. Bouchard et al. (2011). "Prenatal exposure to organophosphate pesticides and IQ in 7-year-old children." *Environ Health Perspect* 119(8).

3. Rauh et al. (2011). "Seven-Year Neurodevelopmental Scores and Prenatal Exposure to Chlorpyrifos, a Common Agricultural Pesticide" *Environ Health Perspect.* 119(8): 1196-1201.

4. Whyatt et al. (2011) "Maternal Prenatal Urinary Phthalate Metabolite Concentrations and Child Mental, Psychomotor and Behavioral Development at Age Three Years." *Environmental Health Perspectives*,

5. Slotkin, T., Does early-life exposure to organophosphate insecticides lead to prediabetes and obesity? *Reproductive Toxicology*, 2011. 31(3): p. 297-301.

Pesticides versus Pharmaceuticals

Pharmaceuticals –designed to heal

- Phase 1 & 2 trials (in vitro & in vivo)
- Phase 3 clinical trials
- Supervised use with labels
 - specify dose, age, health condition, other drugs, CIs
- Phase 4 post-market surveillance
 - withdrawn if problems detected

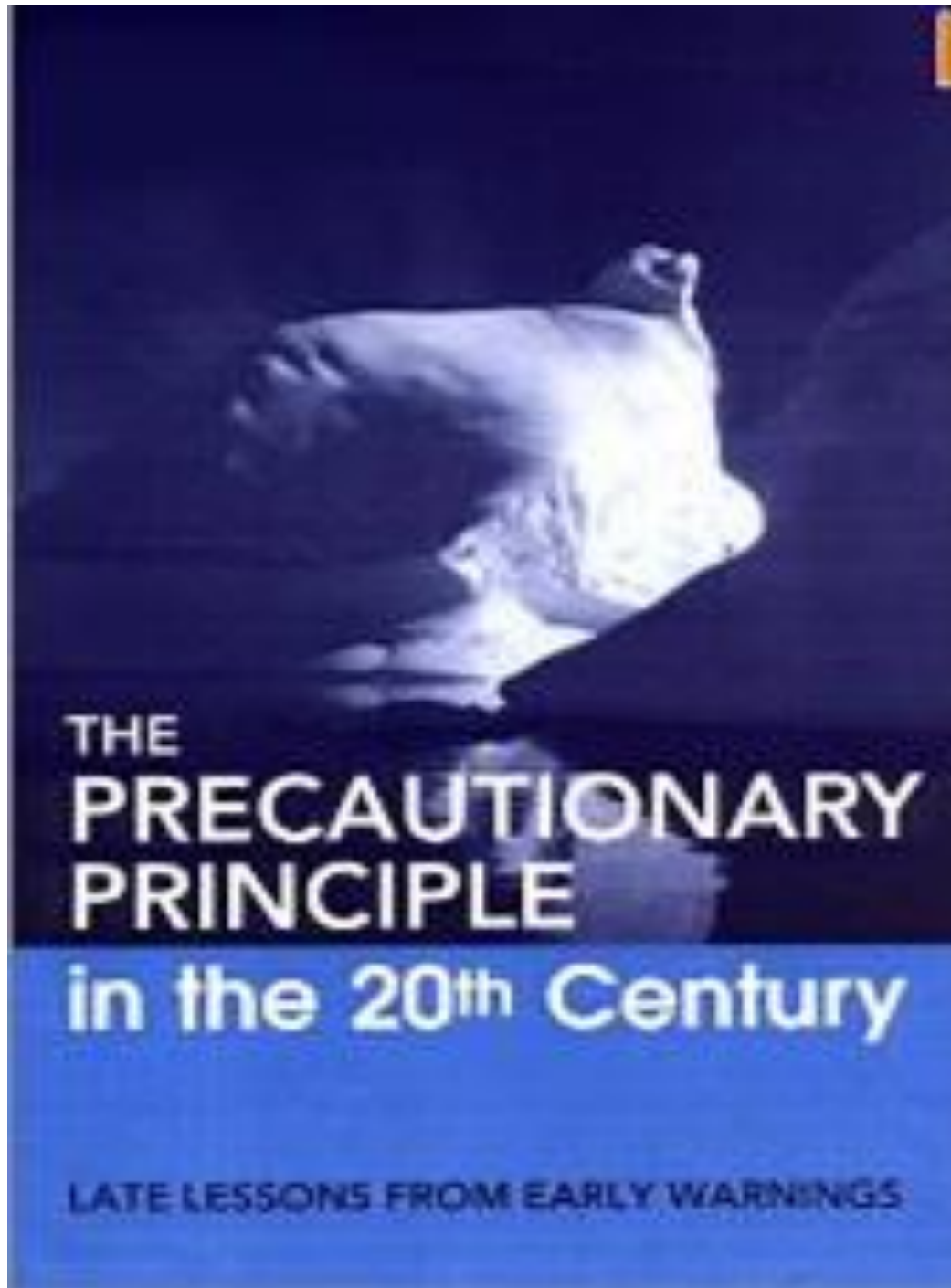


Pesticides – designed to kill

- In vitro & in vivo trials determine ADI
- No clinical trials or monitoring
- Whole population can take ingest at varied doses throughout lifespan
- No monitoring of population
 - only withdrawn after global action (DDT etc)



Precaution is the Principle



"Better safe than sorry"

The Precautionary Principle -

The idea that action should be taken to prevent harm to the environment and human health, even if scientific evidence is inconclusive

Late Lessons from Early Warnings

- CFCs, PCBs, BSE, DES, sulphur dioxide, antibiotics as growth promoters, asbestos

Lifestyle measures reduce exposure



- Fresh organic food
- Minimise food packaging & receipt handling
- Hand washing
- Reduce dust exposure
- Indoor plants



‘Food Rules’

Eat Food, not too much, mostly plants

Don't Eat Anything . . .

- that won't rot
- that has a TV ad
- you couldn't make yourself
- with ingredients you cannot pronounce
- that is labelled ‘diet’, ‘fat free’ or ‘low fat’
- your grandmother wouldn't recognise as food



Michael Pollan

Consume Low and SLOW



Consume low on the food
and processing chain
-minimise use of chemicals,
packaging, personal care
products, money (receipts)

Eat **S**easonal
Local
Organic
Whole

Organic food reduces pesticide exposure



American toddlers eating mostly organic food were found to have less than one sixth the pesticide residues in their urine

This lowered their exposure from *above* to *below* recognised safety levels

Curl et al Organophosphorus pesticide exposure of urban and suburban pre-school children with organic and conventional diets. *Environ Health Perspect.* 2003;111:37-382.

Lu, et al., Organic diets significantly lower children's dietary exposure to organophosphorus pesticides. *Environ Health Perspect* 2006. 114: p. 260–263.

Organic food reduces pesticide exposure



Australian adults reduced their urinary OP pesticide metabolites by 90% after one week of eating mostly organic food

The health advantage of this (if any) remains unknown

Oates, L., Cohen, M., Braun, L., Schembri, A., & Taskova, R. (2014). Reduction in urinary organophosphate pesticide metabolites in adults after a week-long organic diet. *Environmental Research*, 132(0), 105-111.

American Academy of Paediatrics Position on Organic Food

- There is little nutritional difference between organic and conventional food.
- Organic food has less pesticides and antibiotic resistant bacteria
- Young children are uniquely vulnerable to chemical exposures
- No studies yet have examined health impacts of reducing chemical exposure
- Large studies that measure environmental exposures and neurodevelopment are needed.



CLINICAL REPORT

Organic Foods: Health and Environmental Advantages and Disadvantages

abstract

FREE

The US market for organic foods has grown from \$3.5 billion in 1996 to \$28.6 billion in 2010, according to the Organic Trade Association. Organic products are now sold in specialty stores and conventional supermarkets. Organic products contain numerous marketing claims and terms, only some of which are standardized and regulated.

In terms of health advantages, organic diets have been convincingly demonstrated to expose consumers to fewer pesticides associated with human disease. Organic farming has been demonstrated to have less environmental impact than conventional approaches. However,

Joel Forman, MD, Janet Silverstein, MD, COMMITTEE ON NUTRITION, and COUNCIL ON ENVIRONMENTAL HEALTH

KEY WORDS

organic food, produce, meat, dairy, growth hormone, antibiotic farming, diet

ABBREVIATIONS

GH—growth hormone
NOP—National Organic Program
USDA—US Department of Agriculture

This document is copyrighted and is property of the American Academy of Pediatrics and its Board of Directors. All authors have filed conflict of interest statements with the American Academy of Pediatrics. Any conflicts have been resolved through

The Dirty Dozen vs Clean 15

The infographic is split into two vertical panels. The left panel features a red apple at the top with a green banner that reads "Dirty Dozen™ buy these organic." Below the apple is the text "EWG's 2011 Shopper's Guide to Pesticides in Produce™" and a shopping cart icon. The right panel features a yellow onion at the top with a green banner that reads "Clean 15™ Lowest in Pesticides." Below the onion is a QR code and the text "Scan to see more! Get a QR app from www.i-nigma.mobi". Both panels have the website "foodnews.org" in the top right corner. A central orange banner with a dashed border contains the letters "I" for Imported and "D" for Domestic.

foodnews.org

Dirty Dozen™
buy these organic.

EWG's 2011 Shopper's Guide
to Pesticides in Produce™

WORST

1. Apples
2. Celery
3. Strawberries
4. Peaches
5. Spinach
6. Nectarines **I**
7. Grapes **I**
8. Sweet bell peppers
9. Potatoes
10. Blueberries **D**
11. Lettuce
12. Kale/collard greens

I Imported
D Domestic

foodnews.org

Clean 15™
Lowest in Pesticides.

Scan to see more!
Get a QR app from www.i-nigma.mobi

BEST

1. Onions
2. Corn
3. Pineapples
4. Avocado
5. Asparagus
6. Sweet peas
7. Mangoes
8. Eggplant
9. Cantaloupe **D**
10. Kiwi
11. Cabbage
12. Watermelon
13. Sweet potatoes
14. Grapefruit
15. Mushrooms

Diet and Persistent Pollutants



Image source: www.blisstree.com/2012/01/23/food/why-do-vegans-and-meat-eaters-hate-each-other-693/

- Vegans were found to have lower OC levels compared to omnivores¹
- Consuming animal products was related to OC levels in umbilical cord samples²
- Lowest levels of DDT and PCBs were found in milk from lacto-vegetarians³

[1] Arquin et al (2010) Impact of adopting a vegan diet or an olestra supplementation on plasma organochlorine concentrations: results from two pilot studies. *Br J Nutr.* 103(10):1433-41

[2] Mariscal-Arcasa et al (2010) Organochlorine pesticides in umbilical cord blood serum of women from Southern Spain and adherence to the Mediterranean diet *Food and Chemical Toxicology* 48(5)

[3] Noren, K., (2008) Levels of organochlorine contaminants in human milk in relation to the dietary habits of the mothers *Acta Paediatrica* 72(6), 811-816

Food packaging as a source of BPA and phthalates



- 20 participants in 5 families
- 3 days eating fresh organic food
- 66% ↓ urinary BPA
- 55% ↓ urinary phthalates (DEHP)

Rudel RA, et al. 2011. Food Packaging and Bisphenol A and Bis(2-Ethylhexyl) Phthalate Exposure: Findings from a Dietary Intervention. *Environ Health Perspect* :- . doi:10.1289/ehp.1003170.

Food contamination as a major source of BPA and phthalates



- Dietary replacement versus recommendation to reduce BPA and phthalate exposure
- BPA and Phthalates unexpectedly increased in Dietary Replacement Arm (n=21) with no change in recommendation Arm (n=19)
- Phthalates went from 283.7 nmol/g to 7027.5 nmol/g (P<0.0001)
- Testing for DEHP revealed high concentrations in milk and ground coriander

BPA & canned food

- 75 Harvard staff and students
- Randomised to lunch of canned or fresh vegetable soup for 5 days
- Canned soup increased BPA levels by 1221%



Carwile JL, Ye X, Zhou X, Calafat AM, Michels KB. (2011) Canned soup consumption and urinary bisphenol A: a randomized crossover trial. *JAMA*. 2011 Nov 23;306(20):2218-20.

BPA and drinking bottles

- 77 Harvard staff & students
- 1 week of drinking cold beverages from polycarbonate drinking bottles
- Increased urinary BPA by 69%
($p < 0.0001$)



BPA and Thermal Receipts



- 12 Harvard MPH students
- Measured urinary BPA after handling receipts for 2 hours with/without gloves
- BPA was detected in 83% of participants (mean 1.8ug/L) at baseline and in 100% of participants (mean 5.8ug/L) post-simulation without gloves (P=0.005)
- No change was observed after handling receipts with gloves

BPA and Thermal Receipts



Holding thermal receipts after washing hands with hand sanitizer containing dermal penetrants -

- Increased BPA transfer to food
- Increased absorption of lipophilic compounds 100 fold and bypasses the liver
- Led to rapid and dramatic increase in unconjugated BPA in serum (~7ng/mL) and urine (~20 μ g)

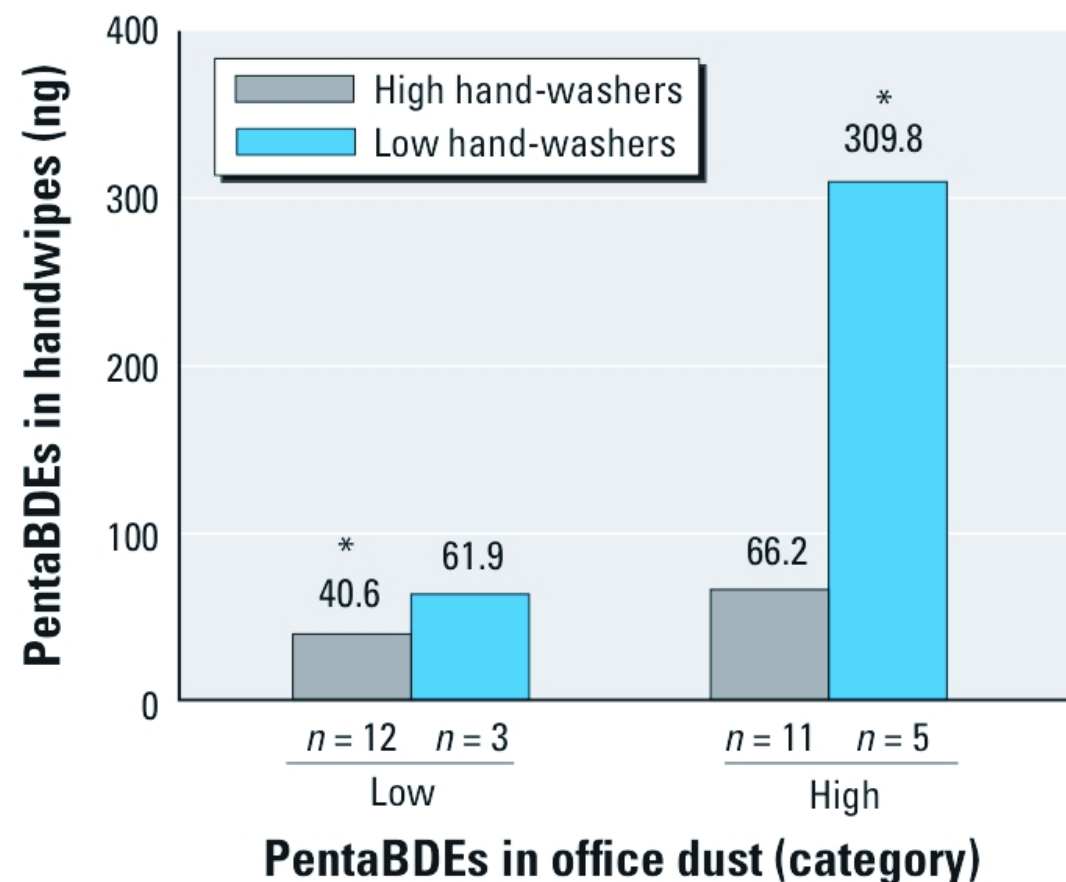


Handwashing & PBDE exposure



Serum, office dust, and handwipe samples from 31 participants who spent >20 hr/week in an office were tested for pentaBDE

Low hand-washers had 3.3 times the PBDE levels in their handwipes than did high hand-washers ($p = 0.02$)



Common plants combat indoor air pollution



Potted-plant microcosms provide effective, self-regulating, sustainable bioremediation for VOCs

Reduce Formaldehyde, xylene/toluene, benzene chloroform, ammonia, acetone

Reduces ozone ¹ and volatile organic compounds in indoor air to below GC detection limit within 24hr ²



Green your life

- *“The true greening of your own life is the basic requirement of a sustainable planetary civilization.”* – Vandana Shiva

Agriculture and food is an area where everyone can begin today.



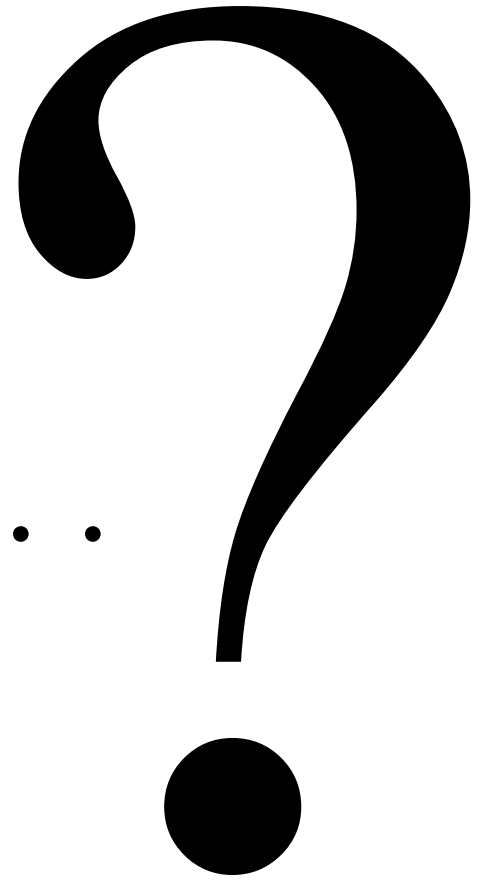
Many Questions Remain



- What are levels of different toxicants?
- How do they vary across populations?
- What are the main exposure/excretory pathways?
- How does exposure/excretion correlate with:
 - Health status?
 - Cognitive function?
 - Nutritional / microbiome status?
 - Genetic polymorphisms / epigenetic changes?
- How can exposure be reduced and excretion enhanced?
- Does detoxification improve health outcomes?

Is eating less poison good for you?

. . . we don't know yet . . .



What level of neurotoxicants are we willing to have in our bodies and our children for the sake of cheap, convenient industrially-produced food?

Imagine a world. . .



- Free of toxic petrochemicals
- Where our lifestyles enhance our wellbeing rather than contribute to chronic disease
- Where food forests and edible landscapes allow everyone to enjoy seasonal, local, organic, whole food
- Everyone interacts with the wealth of the world's knowledge and contributes their own data to benefit others

Imagine . . .