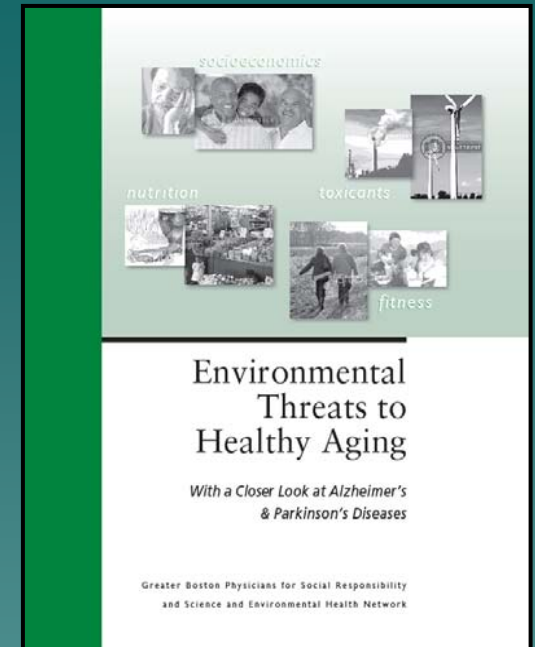


The Chemical Environment: Toxic Chemicals, Hazardous Substances, and Chronic Diseases of Aging

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*Based on the report Environmental Threats to Healthy Aging
by Jill Stein MD, Ted Schettler MD, MPH, Maria Valenti and Ben Rohrer
Published by Greater Boston Physicians for Social Responsibility and
The Science and Environmental Health Network*

What We Will Cover

◆ Our modern chemical environment:

- Exposures
- Biomonitoring
- Toxicology

Specific exposures

- Lead and other heavy metals
- Air pollution
- Some pesticides
- Bisphenol A and other endocrine disruptors

◆ Solutions for Healthy People and a Healthy Planet

- Individual actions
- Examples of state and national efforts to reform chemical policy

Environment Drives Chronic Disease

Environmental
Factors



Chronic
Disease

Altered Pathways

- Food system/Diet
- Fossil Fuels
- Socioeconomic Stress
- **Chemicals**
- Built Environment/
Transportation

- **Inflammation**
- **Disrupted Insulin
Signaling**
- **Oxidative Stress**

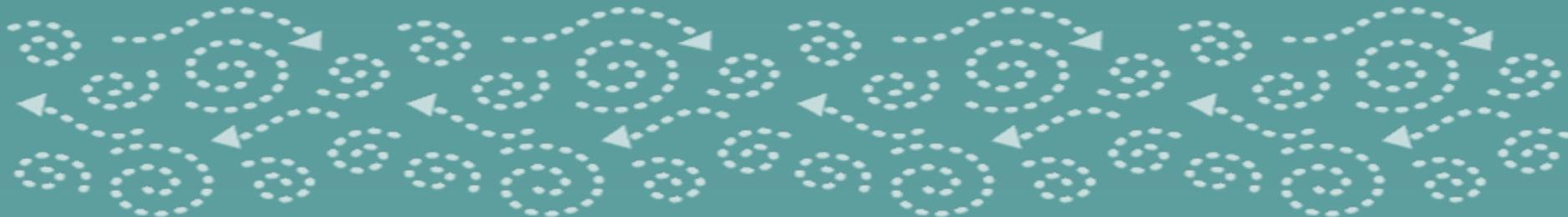
Western Disease Cluster

- Diabetes
- Obesity
- Abnormal Lipids
- Metabolic Syndrome
- Cardiovascular Disease

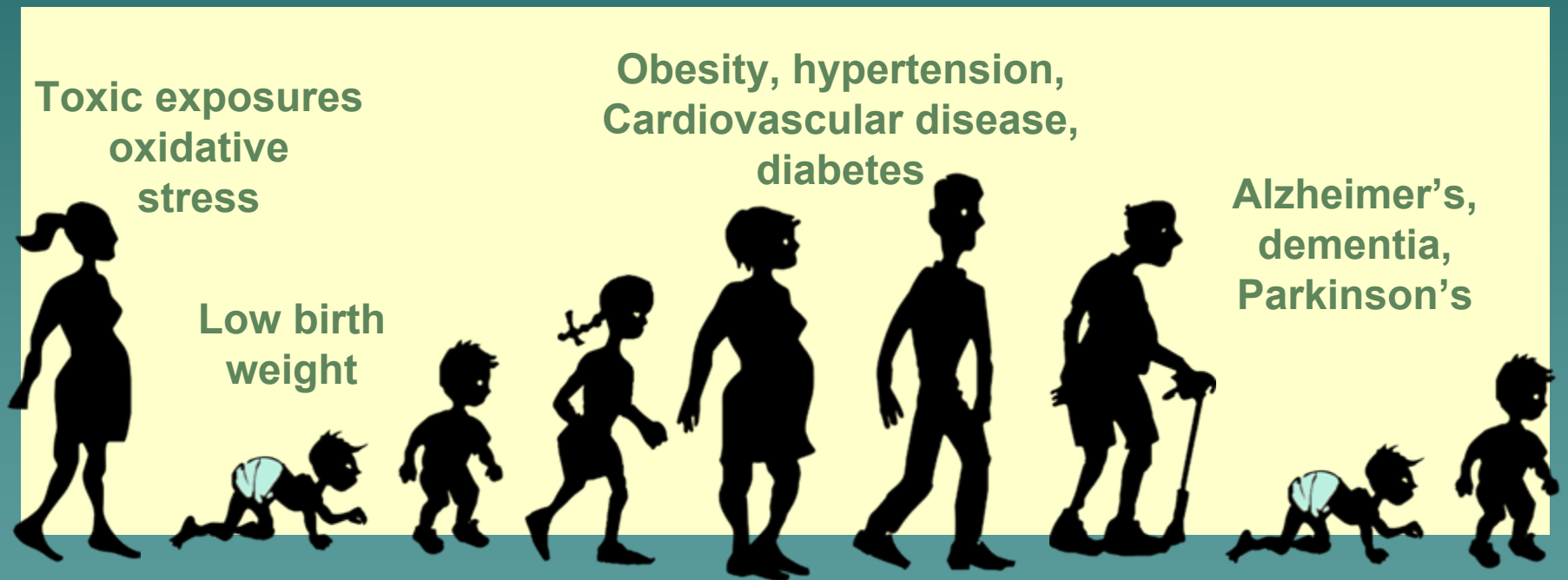


Parkinson's

Alzheimer's



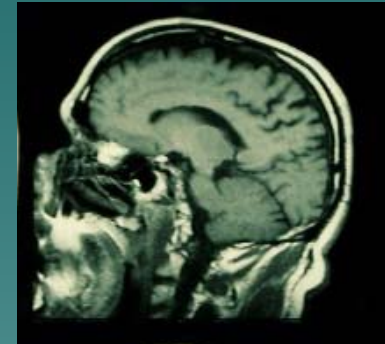
Early life experiences can influence later-life health, disease



Aging begins at conception

Alzheimer's and Parkinson's Diseases

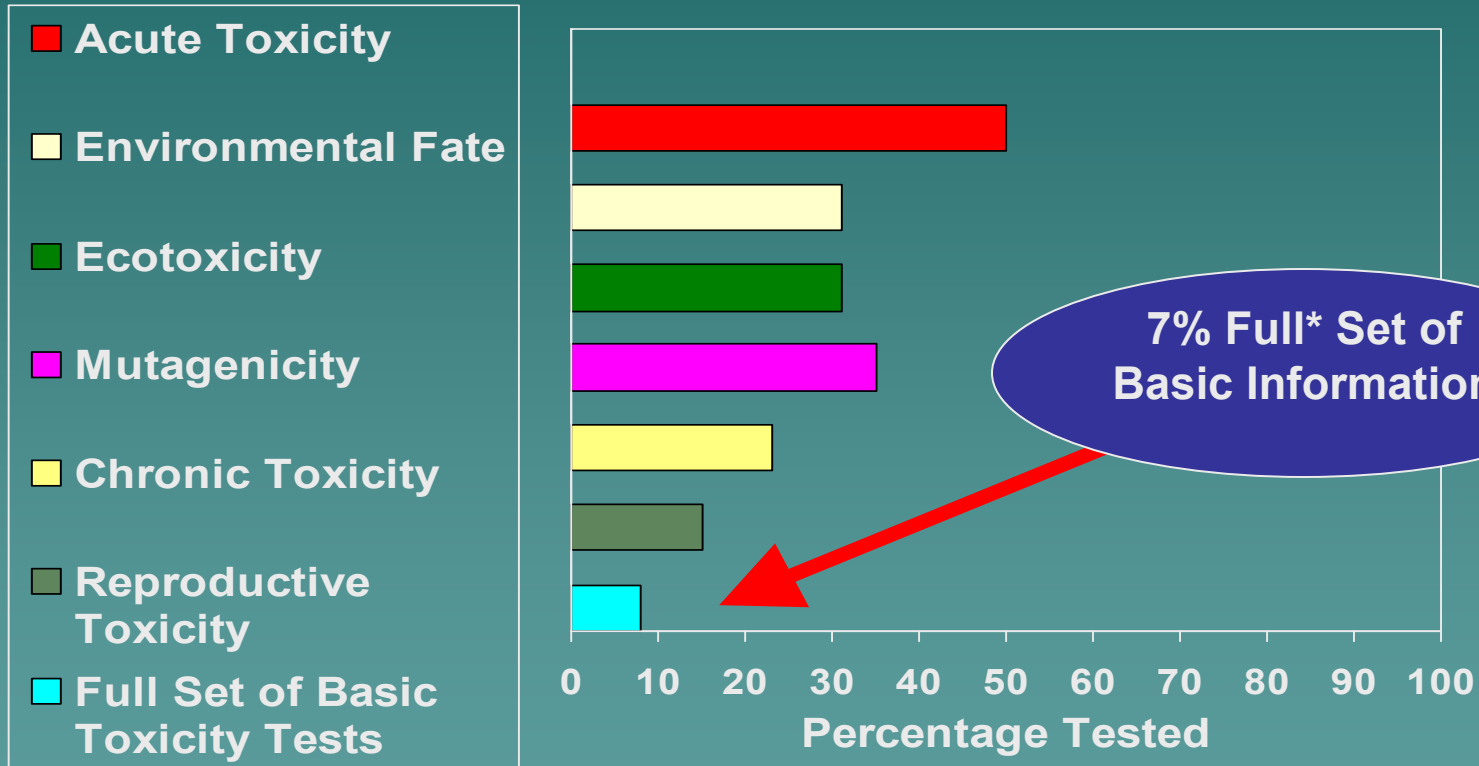
- ◆ Characterized by:
 - abnormal protein deposits
 - chronic inflammation
 - abnormal oxidative stress
- ◆ Many neuroscientists are beginning to think of some neurodegenerative diseases along a continuum, without clearly distinct boundaries in clinical or pathological manifestations



Our Chemical Environment

- ◆ Every day, the U.S. imports or produces approximately 42 billion pounds of chemicals that are used in manufacturing, businesses, homes, schools, and communities.
- ◆ Synthetic chemicals now contaminate all global ecosystems.
- ◆ They are in consumer products, food, water, sediments, soil, house dust, and air.
- ◆ 68,000 licensed by “grandfathering” in 1977.
- ◆ 84,000 licensed now.

Hazard Data for HPV Chemicals



The National Report on Human Exposure to Environmental Chemicals

From the Centers for Disease Control & Prevention

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



In some people and age groups, levels are much higher.

- ◆ Infants and children:
 - frequent hand-to-mouth activity → ingestion of contaminated house dust or soil.
 - Greater respiratory rate → more effects of air pollution.
- ◆ Workplace exposures
- ◆ People, poor or minorities, who live near hazardous waste sites or on contaminated land → likely contributes to health disparities.

Chemicals of Particular Concern: Persistent and Bioaccumulative

- ◆ Persistent: last for decades or indefinitely, e.g. lead, mercury, DDT.
- ◆ Bioaccumulative: high concentrations in dairy products, meats, and large predatory fish.

Toxicology is advancing.

Toxicology in the 1970s

- ◆ Primarily studied exposures in adult males.
- ◆ The greater the dose, the bigger the effect.
- ◆ One chemical at a time.

Toxicology today

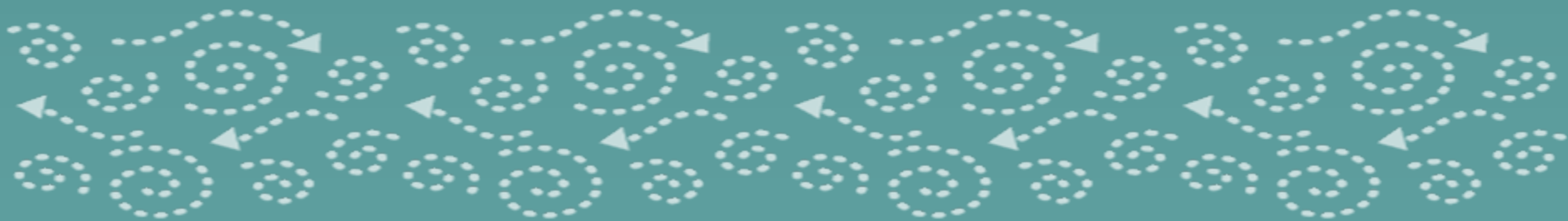
- ◆ “Windows of development” - timing is critical.
- ◆ Different dose-response curves.
- ◆ Mixtures can amplify, change, or mute effects.

Environment Drives Chronic Disease



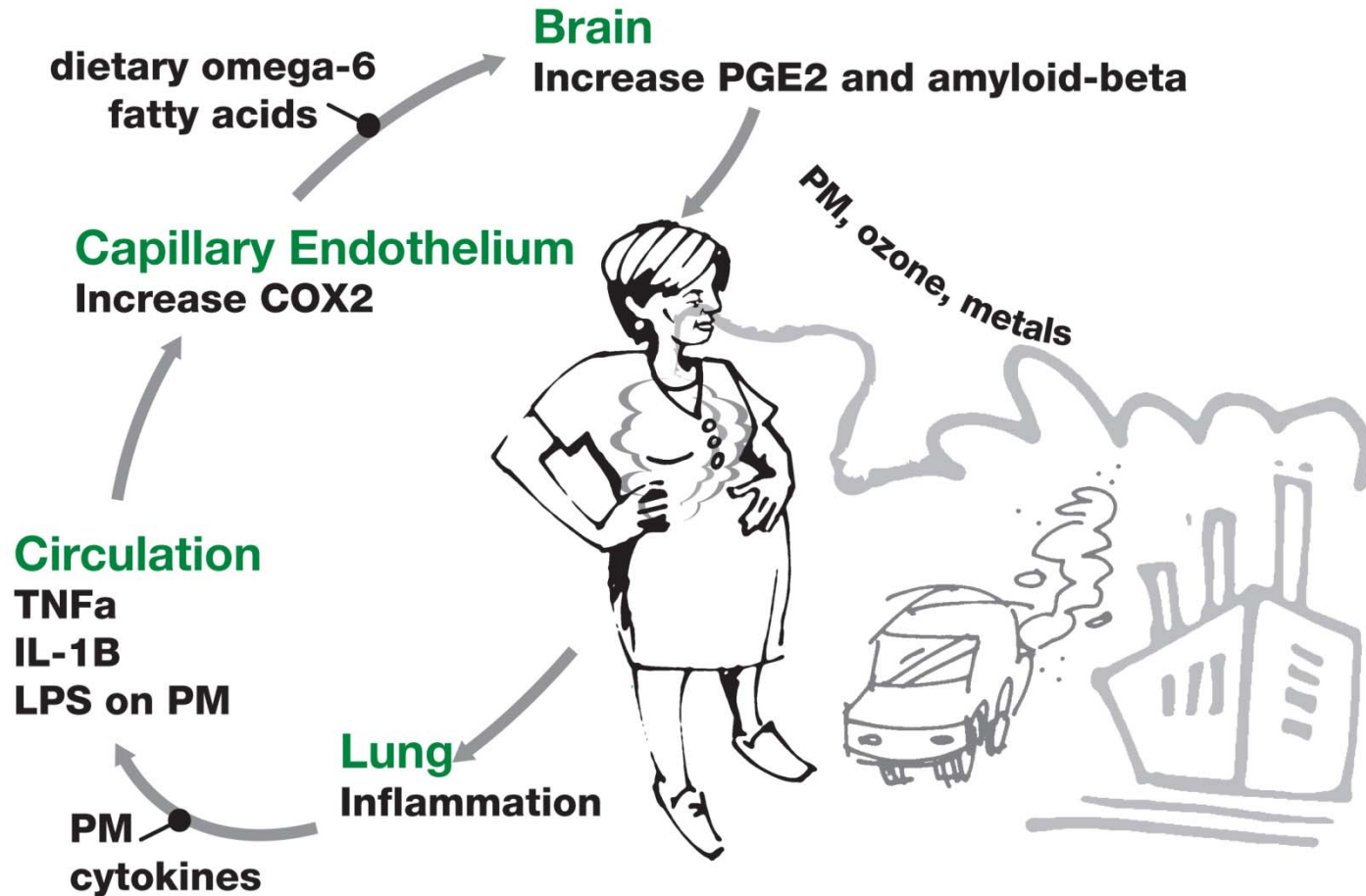
Toxic Chemicals

Air pollution,
Lead and other heavy metals,
Some Pesticides,
Bisphenol A and other Endocrine Disruptors



From the Smoke Stack to Your Brain

Air Pollution is Linked to Brain Inflammation
& Amyloid-Beta Deposition



VOCs and Indoor Air

- ◆ VOCs: cleaning, degreasing, extraction, surface coating, laboratory work, in-home repairs, and remodeling, as components of paints, inks, glues, adhesives, and fuels.
- ◆ Toxic to the brain and nervous system, impair reproduction and child development, and cause cancer.
- ◆ Effects on nervous system: mood swings, depression; impaired cognition, concentration, and memory.
- ◆ In addition, exposures to some solvents in the workplace increase the risk of Parkinson's disease.

Lead

Cumulative occupational exposure

- ◆ ↑ cognitive impairment Shih 2007
- ◆ 2x risk Parkinson's Coon 2006

Cumulative community exposure

- ◆ ↑ cognitive impairment Shih 2006
- ◆ Up to 15 years cognitive aging Weisskopf 2004

Animal studies of early life exposure

- ◆ Late-life Alzheimer's markers Basha 2005, Lahiri 2007.

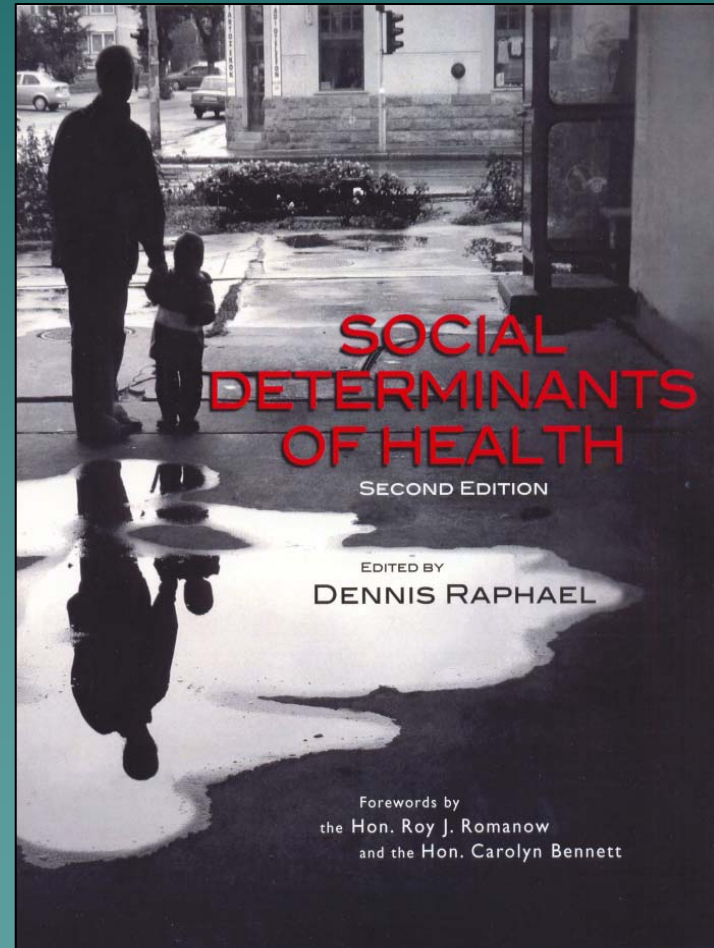


Vulnerable Communities

- ◆ Stress, depression → risk for CVD, AD Sesso, Kario, Ownby

- ◆ People with lower SE status are at risk for exposure to multiple environmental hazards → ↑ damage.

- Lead + stress → ↑ cognitive impairment Glass 2009
- Lead + air pollution → ↑ CV autonomic dysfunction Park 2008



Pesticides

◆ Parkinson's Disease

- Human studies - 24/31 studies show ↑ risks for PD. (OR 1.6-7) Brown 2006
- Animals - Rotenone & paraquat → damage dopaminergic neurons in striatal region of brain
 - Combinations of maneb and paraquat; prenatal exposure “primes” the brain, increasing adult susceptibility Cory-Slechta 2005

◆ Cognitive decline/dementia

- Low level fungicides in vineyards → 3.5x poor attention, memory Baldi 2001
- Occupational exposure associated with 2x risk of developing AD Baldi 2003

◆ Insulin Resistance, metabolic syndrome Lee 2006, 2007, 2007

- Some persistent pesticides show strong dose-response relation to insulin resistance and metabolic syndrome.





Bisphenol A

- ◆ Found in polycarbonate plastic, resins, sealants.
- ◆ Exposures are nearly ubiquitous.
- ◆ Endocrine disruptor, oxidative stress.
- ◆ Causes fat accumulation & insulin resistance at low levels (animals). Alonso-Magdalena 2006, Wada 2007
- ◆ 3-fold ↑ Cardiovascular disease. Lang 2008
- ◆ 2-fold ↑ Insulin Resistance. Lang 2008



BPA and Health Concerns

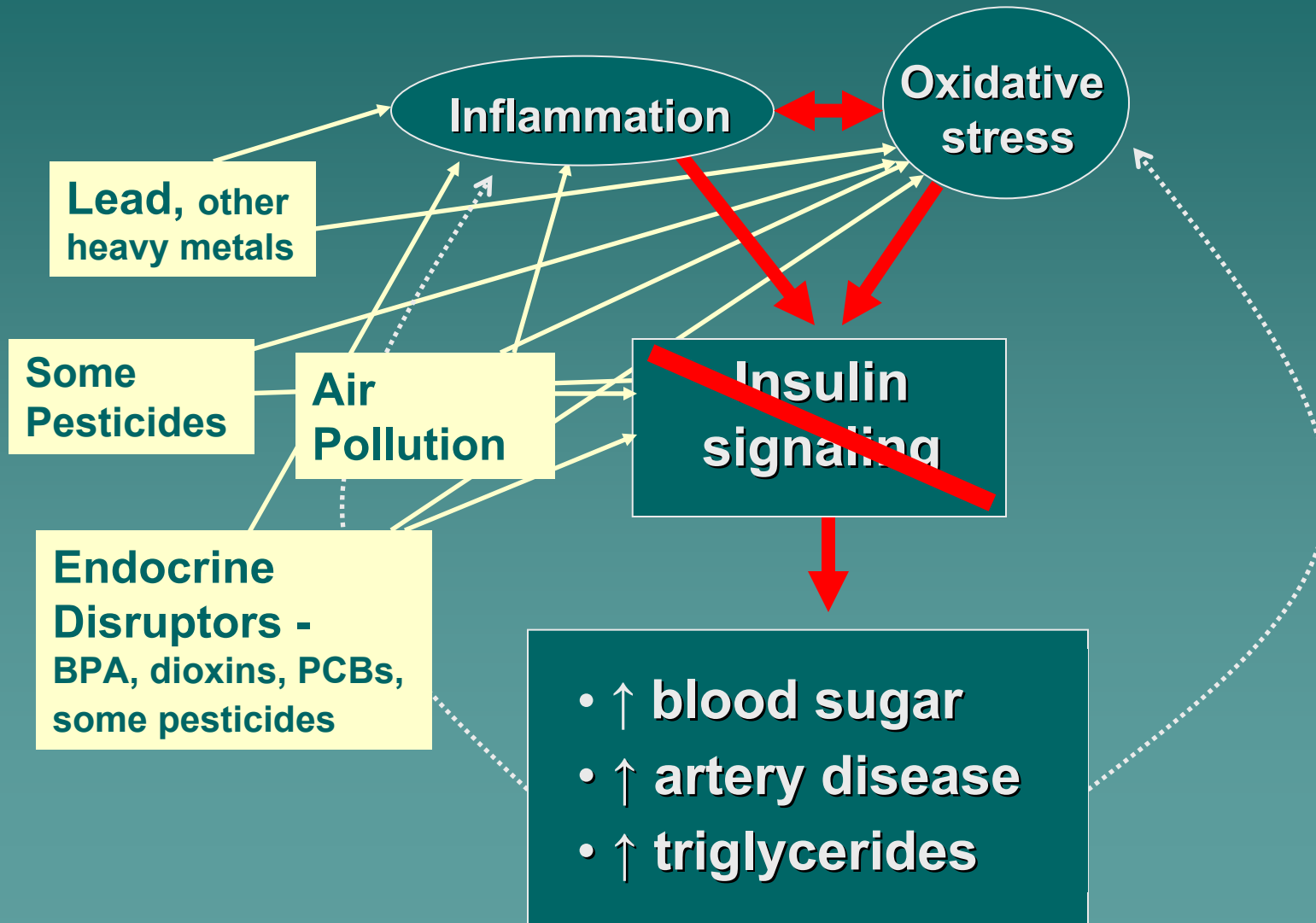
- ◆ Reproductive effects, male and female
- ◆ Recurrent miscarriages
- ◆ Insulin resistance, diabetes & obesity
- ◆ Heart Disease
- ◆ Altered brain development (recent)
- ◆ Cancers
 - Prostate
 - Breast
 - Decreased antioxidant enzymes
- ◆ Altered immune function
- ◆ Behavioral effects
 - Alters attention, activity



Potential Effects of Endocrine Disruption

- ◆ Falling age of puberty in girls
- ◆ Obesity and diabetes
- ◆ Heart Disease
- ◆ Male genital abnormalities
- ◆ Regional decreases in sperm count
- ◆ Cancers
 - Breast
 - Prostate
- ◆ Neurobehavioral problems, e.g. autism, hyperactivity

Environmental Factors Disrupt Insulin Signaling, Drive Inflammatory Metabolism



Solutions

for

Healthy People & A Healthy Planet



Major Illnesses Are Preventable

Personal Actions to Profoundly Reduce Risks

Personal Level – “Approaches to Healthy Living”

- ◆ Eat healthy – whole, fresh, unprocessed, plant based foods
- ◆ Exercise
- ◆ Be socially engaged
- ◆ Avoid toxicants whenever possible



President's Cancer Panel 2009



REDUCING ENVIRONMENTAL CANCER RISK

What We Can Do Now

U.S. DEPARTMENT OF HEALTH AND
HUMAN SERVICES National Institutes of
Health **National Cancer Institute**

State & Local Initiatives

- ◆ Prioritizing chemicals of high concern
- ◆ Requiring manufacturers to disclose the chemicals in their products
- ◆ Chemical specific bans
- ◆ Investment in Green Chemistry
- ◆ TSCA Reform



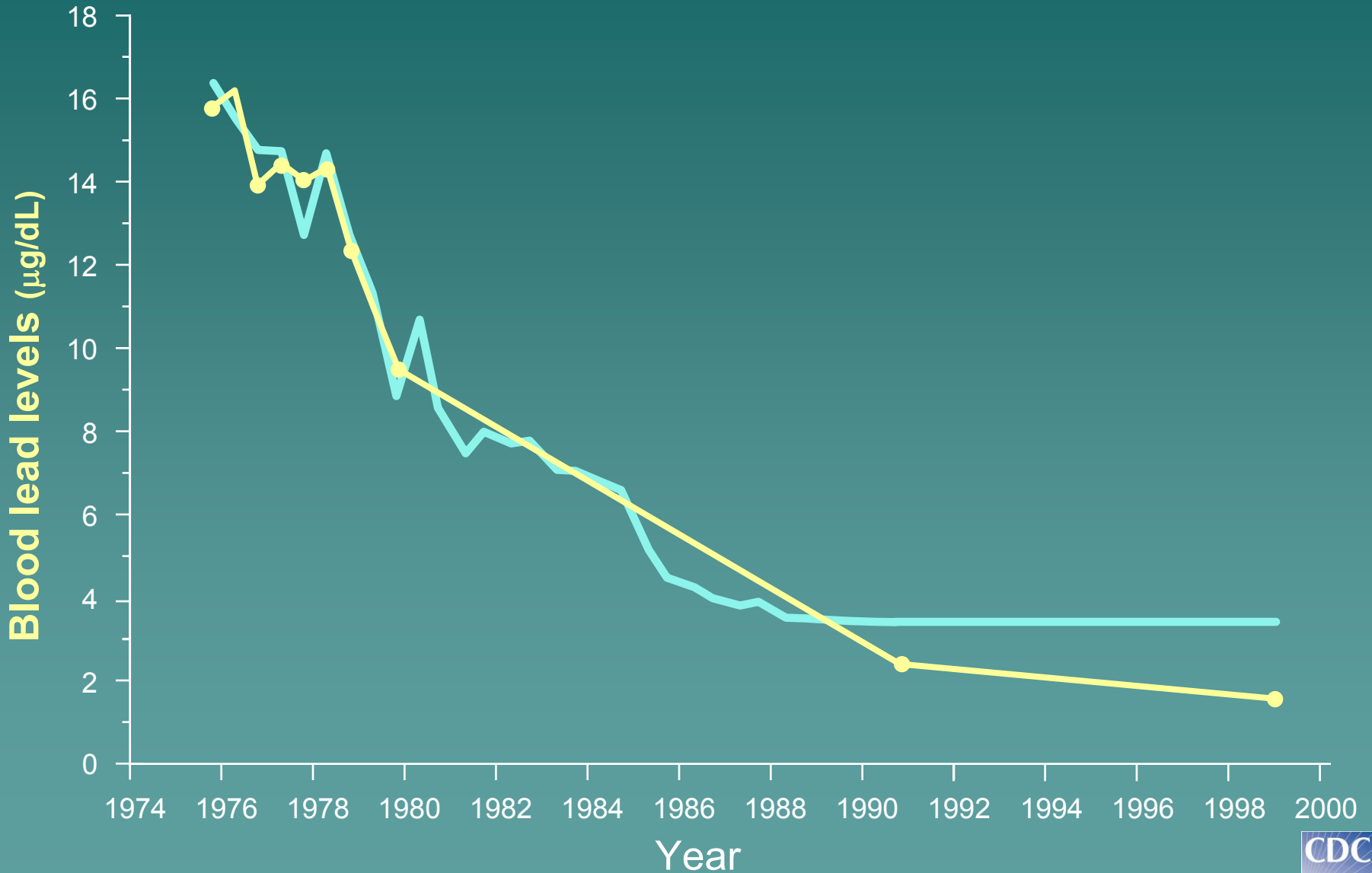
Toxic Chemicals Safety Act

TSCA Reform

- ◆ **Requires that all chemicals are proven safe**
- ◆ **Uses the best science available**
- ◆ **Informs the market, consumer and the public**
- ◆ **Promotes environmental justice**
- ◆ **Boosts innovation, development of safer chemicals and jobs**
- ◆ **Supports the states and tribes**

Blood lead levels in the U.S. population 1976 -1999

NHANES II, III, 99+



Acknowledgements

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