

# Plastics: Human Health Impacts

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g  
oz  
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Range	Resolution	Accuracy
0 - 6000 g [0 - 12 lb]	2 g [0.1 oz]	±0.034% of reading
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ON/ZERO OFF BEFORE NURSING WEIGHT ENTRY AFTER NURSING WEIGHT GAIN REWEIGH





Paradise, California  
November, 2018  
88 dead



A silhouette of the San Francisco skyline is visible against a hazy, orange-tinted sky. The Transamerica Pyramid is the most prominent building in the center. To the right, the Coit Tower is visible. A single bird is captured in flight in the center of the image. The foreground shows dark silhouettes of buildings and trees.

Environ Health Perspect. 2016 Oct;124(10):1651-1655. Epub 2016 May 13.

## **Urinary Concentrations of Bisphenol A and Phthalate Metabolites Measured during Pregnancy and Risk of Preeclampsia.**

Cantonwine DE<sup>1</sup>, Meeker JD, Ferguson KK, Mukherjee B, Hauser R, McElrath TF.

So here are our questions...

How did we get into this predicament?

What do we know about human health risks of plastic?

Is there a path forward?

# Better living through chemistry



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You could think of them as the sixth basic food group. Oh, you certainly wouldn't eat them, but plastic packaging does help pro-

help keep air out. While others let air in to help the food we eat stay fresher longer. Plastics also let you see what you're buying.

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tect our food in many ways. • To help lock in freshness, plastic wrap clings tightly to surfaces. To help lock out moisture, resealable containers provide a strong seal. And plastic wrap helps extend the shelf life of perishable produce, poultry, fish and meats. • To prevent spoilage and contamination, some varieties of plastics

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# What nobody really knew



Hormones guide gene expression



EDCs hack the system

# What makes plastic toxic?

The monomer

Additives to plastic

Non-intentionally added substances (NIAS)

Adsorption and absorption



# EDC-2: The Endocrine Society's Statement on Endocrine-Disrupting Chemicals - 2012

A. C. Gore, V. A. Chappell, S. E. Fenton, J. A. Flanagan, and R. T. Zoeller



## Meet the Four Recipients of the Outstanding Public Service Laureate Award

BY TERESA WOODRUFF | FEB 2016

**Outstanding Public Service Award**  
**Jean Pierre Bourguignon, MD, PhD, University of Liege**  
**Andrea Gore, PhD, University of Texas**  
**J. Pete Myers, PhD, Environmental Health Sciences**  
**Thomas Zoeller, PhD, University of Massachusetts**



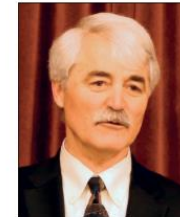
Andrea Gore, PhD

Among the varied contributions of these individuals are co-authorship of the 2009 Scientific Statement on EDCs, integration of the topic into the Endocrine Society's scientific offerings, and expansion of the Society's advocacy beyond the U.S. borders. They have represented the Society to the U.S. Congress, U.S. EPA, EU Parliament, and the EU Commission, traveling around the globe to ensure that the best science is considered when environmental standards are created. In the process they have been tremendous stewards for the field of endocrinology.

For Outstanding Public Service, the Endocrine Society recognizes Drs. Andrea Gore, R. Thomas Zoeller, John Peterson (Pete) Myers, and Jean-Pierre Bourguignon for their citizenship, outreach, and scientific leadership in the area of endocrine-disrupting chemicals (EDCs).

These four individuals have worked tirelessly with the endocrine community to communicate to the public, scientists, healthcare professionals, and global governments about the role and impacts of EDCs on normal physiology, and how EDCs challenge long-used approaches in id

entifying toxic substances.



Thomas Zoeller, PhD

In addition to these collective advances, each of these individuals has contributed enormously in the following ways. In establishing the Environmental Health Network, Pete Myers changed the relationship between scientists and the press, and improved the accuracy of scientific reporting. In 2005 and again in 2009, Andrea Gore and Tom Zoeller organized the Endocrine Society's Forums on Endocrine Disrupting Chemicals, and played key roles in developing the Endocrine Society Scientific Statement on EDCs in 2009, which was updated in 2015 under Dr. Gore's leadership. Drs. Bourguignon and Zoeller founded and co-chaired task forces dedicated to the Society's global work on EDCs and, in 2012, Zoeller led the Endocrine Society Statement of Principles for



J. Pete Myers, PhD

Policymakers. Dr. Bourguignon was particularly crucial to engaging the European community on EDC science and policy.



Jean Pierre Bourguignon, MD, PhD

In 2014 all of these individuals signed onto the Endocrine Principles in EDC Policy, which has led the world in thinking about EDC science and health implications. For their public service to the field of endocrinology through their work in Endocrine Disrupting Chemicals the Endocrine Society recognizes and thanks Drs. Andrea Gore, R. Thomas Zoeller, John Peterson (Pete) Myers, and Jean-Pierre Bourguignon.

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# Hormone-related cancers

ADHD  
Learning disabilities  
Pre-term birth  
Allergies  
Weakened immune system  
Infertility  
Heart disease  
Autoimmunity  
Degenerative diseases  
Fibroids  
Obesity  
Asthma  
Autism  
Diabetes  
polycystic ovaries  
Non-alcoholic fatty acid liver disease



A gloved hand is shown in the upper left, holding a pipette tip over a row of test tubes. The test tubes are arranged in a rack and contain a blue liquid. The background is a soft, out-of-focus laboratory setting. The text is overlaid on the image in a white, sans-serif font.

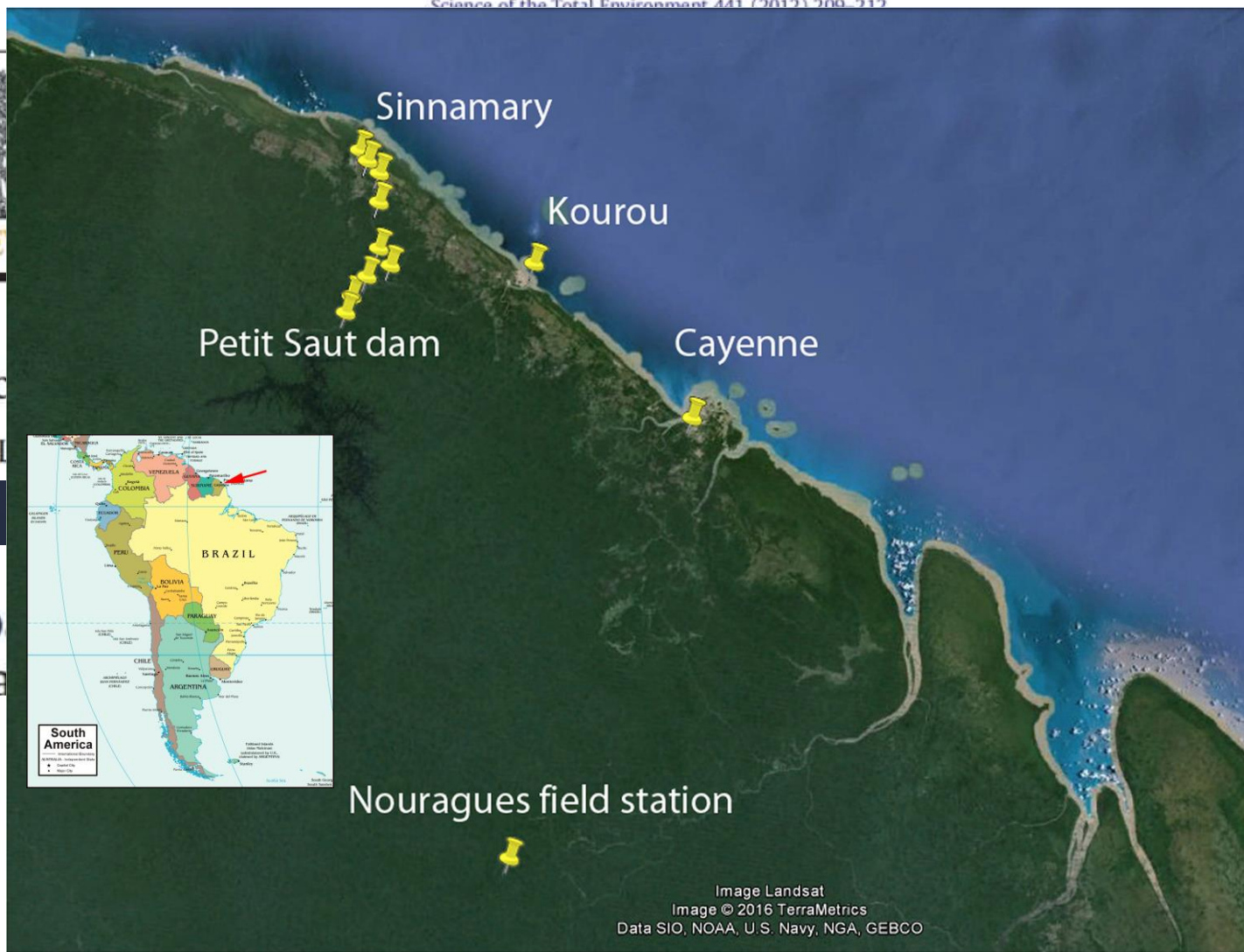
# Revolution in science

1. Exposure to EDCs is ubiquitous
2. Low doses matter a lot
3. Events in the womb don't stay in the womb
4. Testing methods are deeply flawed



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Alain L

Imp  
on a  
Virg  
Pau



ontigny<sup>c</sup>

### Terrestrial pollution in an Amazonian rainforest

Alain Lenoir<sup>1</sup> • Raphaël Boulay<sup>1</sup> • Alain Dejean<sup>2,3</sup> • Axel Touchard<sup>3</sup> •  
Virginie Cuvillier-Hot<sup>4</sup>





A hand in a white glove is shown in the upper left, holding a pipette tip. Below it, a row of test tubes containing blue liquid is visible. The background is a soft, out-of-focus laboratory setting.

# Revolution in science

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# PFAS

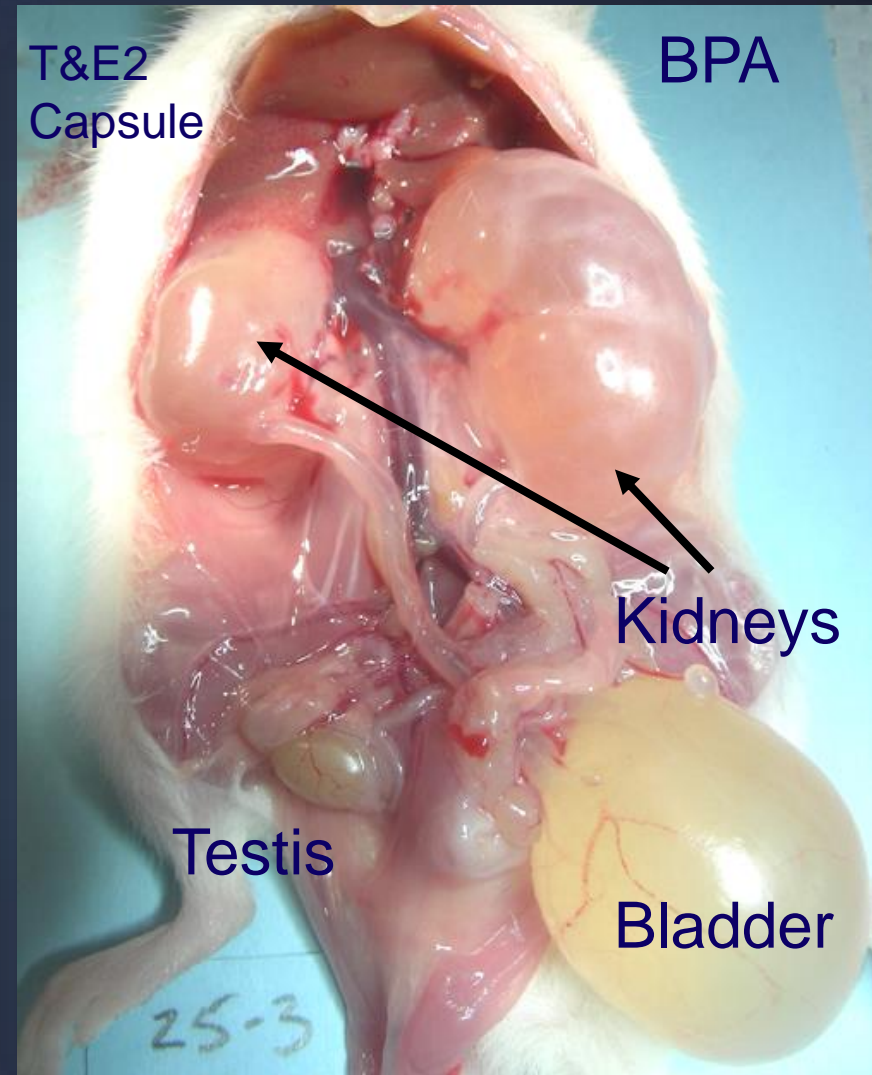
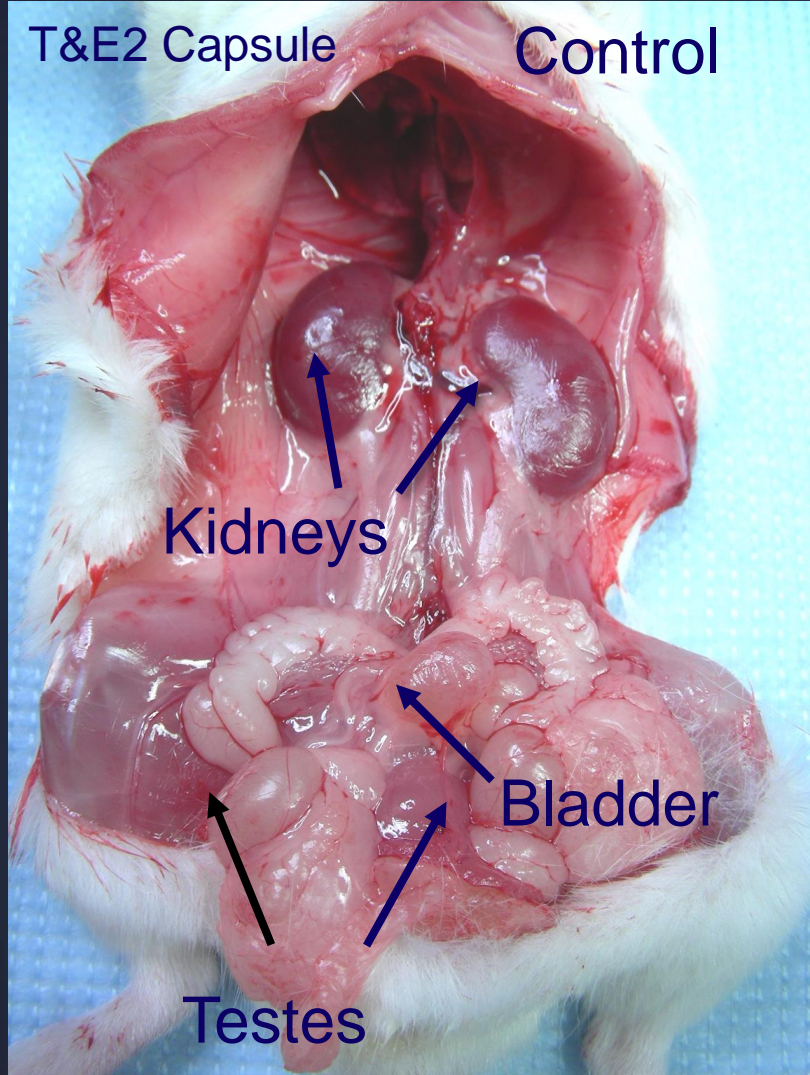
A hand in a white glove is shown holding a pipette tip, positioned over a row of test tubes. The test tubes are arranged in a rack and contain a blue liquid. The background is a soft, out-of-focus blue, suggesting a laboratory setting.

1. Linked to many health outcomes
2. Incredibly persistent
3. Widespread exposure
4. Most recent safe estimate: 0.1 ppt

A hand in a white glove is shown holding a pipette tip, positioned over a row of test tubes. The test tubes are arranged in a tray and contain a blue liquid. The background is a soft, out-of-focus laboratory setting with a light blue tint.

# Revolution in science

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2. Low doses matter a lot
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4. Testing methods are deeply flawed





# SCIENTIFIC REPORTS

The current

study using a transient exposure of gestating F0 generation female rats found negligible impacts of glyphosate on the directly exposed F0 generation, or F1 generation offspring pathology. In contrast, dramatic increases in pathologies in the F2 generation grand-offspring, and F3 transgenerational grand-offspring were observed. The transgenerational pathologies observed include prostate disease, obesity, kidney disease, ovarian disease, and parturition (birth) abnormalities.

Received: 2 October 2018

Accepted: 9 April 2019

Published online: 23 April 2019

## Heritability of Pathologies and Sperm Epimutations: Generational Toxicology

Deepika Kubsad, Eric E. Nilsson, Stephanie E. King, Ingrid Sadler-Riggelman, Daniel Beck & Michael K. Skinner

A hand in a white glove is shown holding a pipette tip, positioned over a row of test tubes. The test tubes are arranged in a rack and contain a blue liquid. The background is a soft, out-of-focus laboratory setting with a blue tint.

# Revolution in science

1. Exposure to EDCs is ubiquitous
2. Low doses matter a lot
3. Events in the womb don't stay in the womb
4. Testing methods are deeply flawed

09.18.19

## Three-quarters of plastic products are toxic

**ENVIRONMENTAL**  
Science & Technology

DOI: 10.1021/acs.est.9b02293

Article

[pubs.acs.org/est](https://pubs.acs.org/est)

### Benchmarking the in Vitro Toxicity and Chemical Composition of Plastic Consumer Products

Lisa Zimmermann,<sup>\*,†</sup> Georg Dierkes,<sup>‡</sup> Thomas A. Ternes,<sup>‡</sup> Carolin Völker,<sup>§</sup>  
and Martin Wagner<sup>†,||</sup>



# Painful realizations

Most chemicals haven't been tested

The tests used are flawed and outdated

Core assumptions are wrong

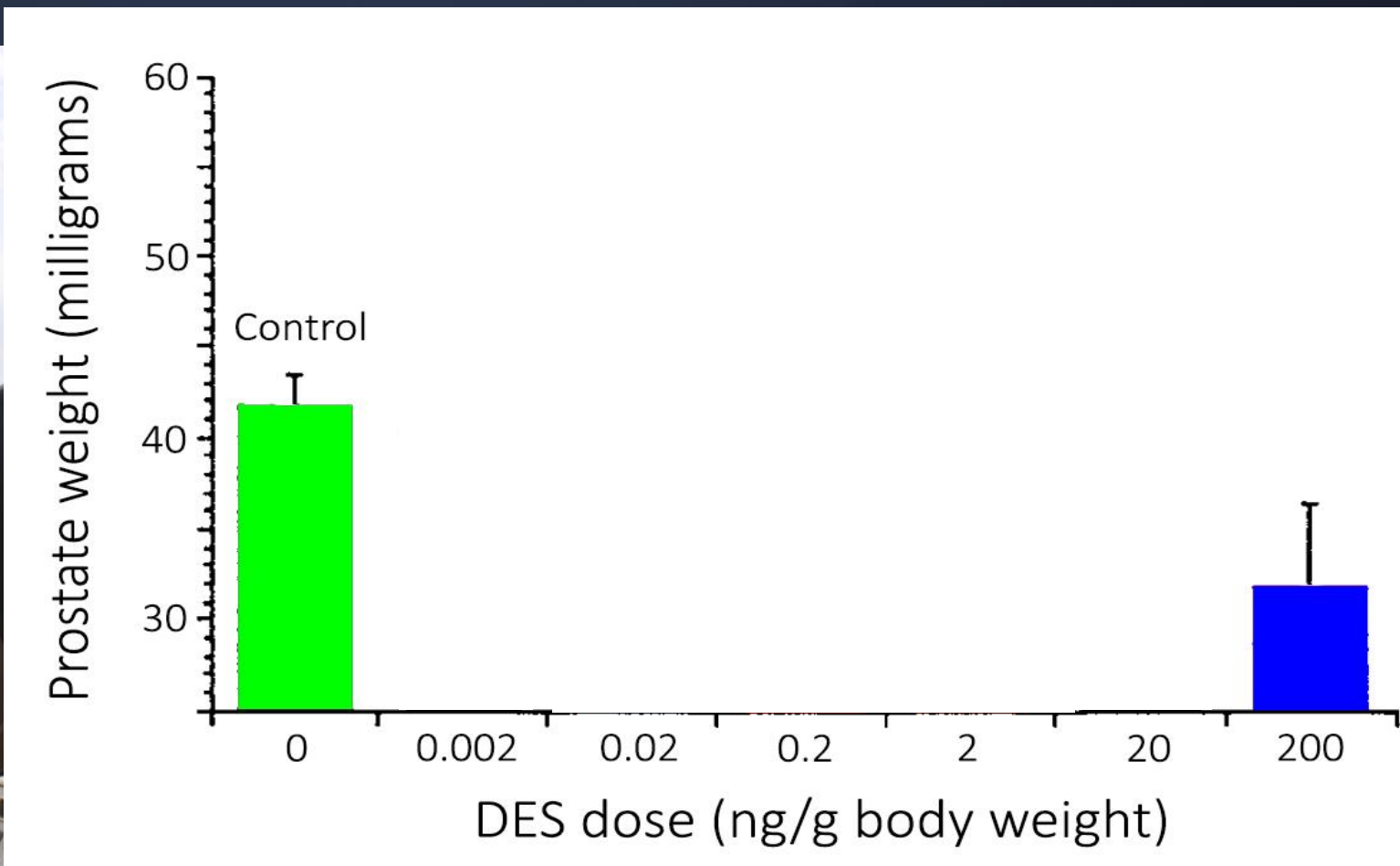
Analyses manipulated to hide problems

Profoundly flawed assumptions

The Paracelsus problem

The cocktail effect

# Epiphany



I began to have questions...

Are 'low doses' really low?

What's a part per billion?

How many molecules?

2.65 trillion



1 part per billion



Same strain of mice  
Same caloric intake  
Same activity levels

Newbold *et al.* 2005, 2007

1 part per billion

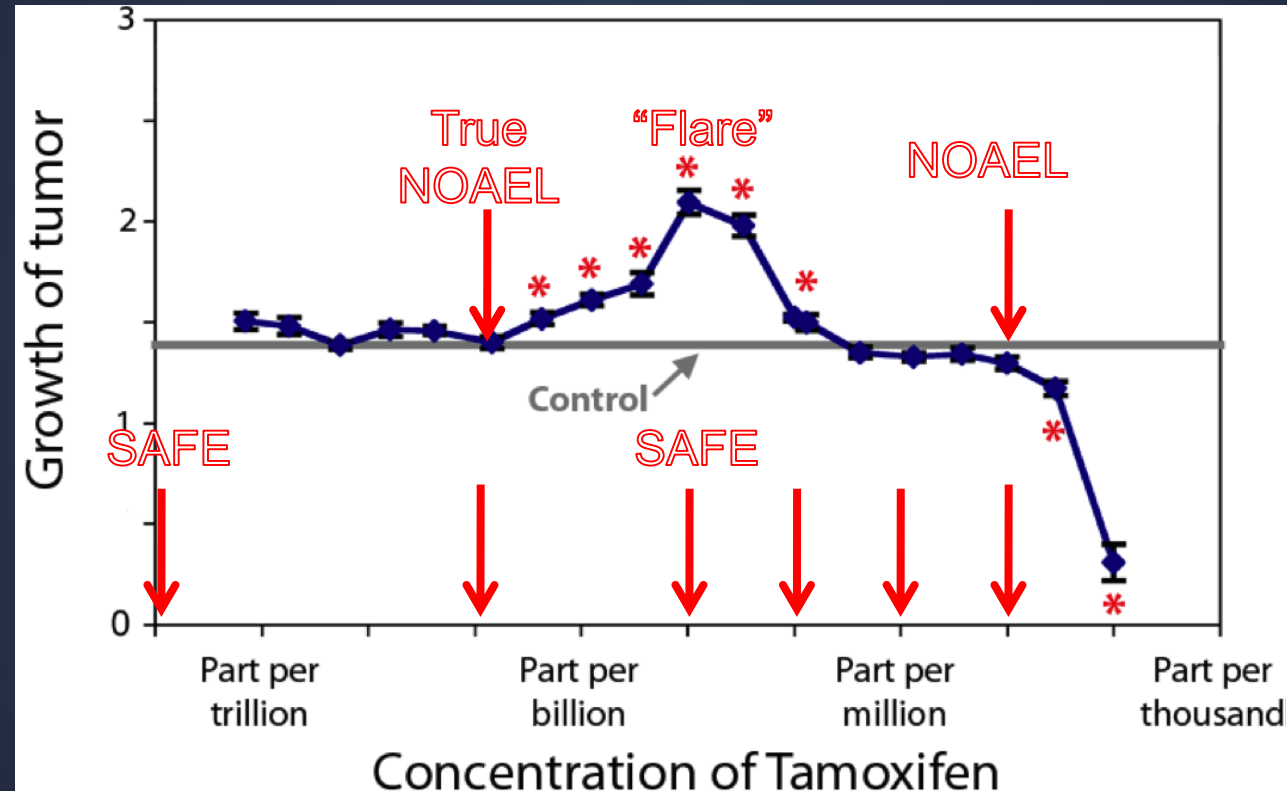
What about 1000 ppb?



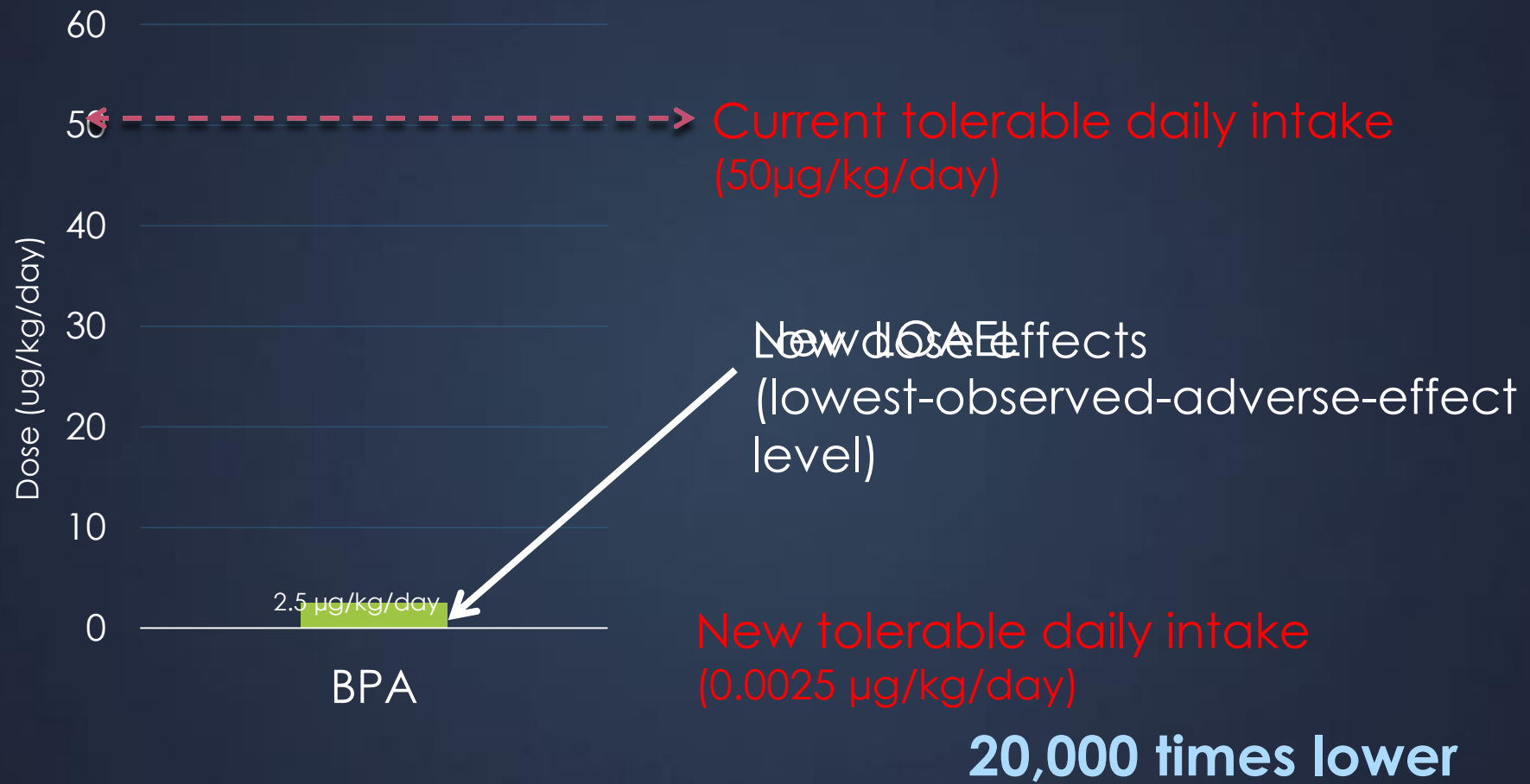
Same strain of mice  
Same caloric intake  
Same activity levels

Newbold *et al.* 2005, 2007

# NON-MONOTONICITY OF TAMOXIFEN



Welshons, in Vandenberg et al. 2012





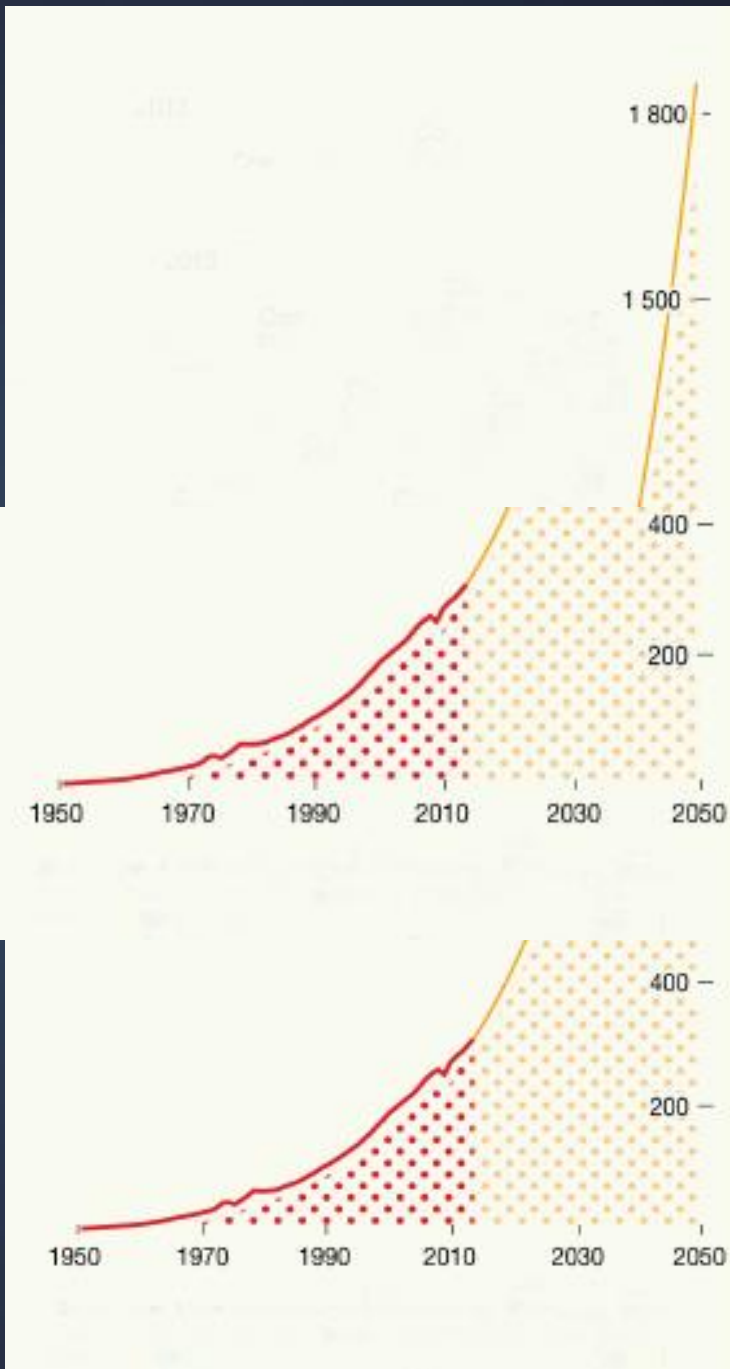
Profoundly flawed assumptions

The Paracelsus problem

The cocktail effect



# Global plastic production millions of tonnes



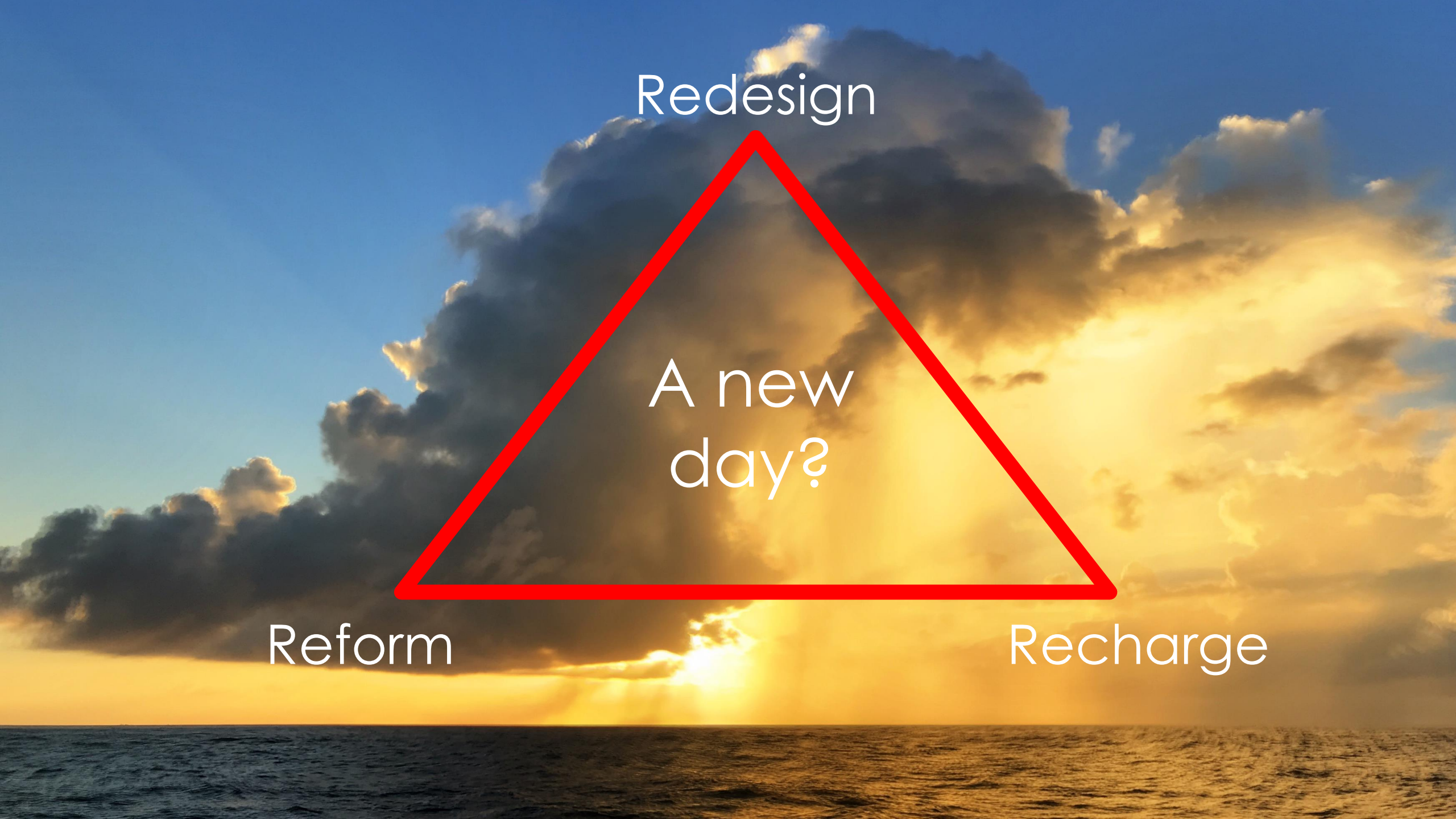


Redesign

A new  
day?

Reform

Recharge





<http://bit.ly/plasticene>



## Into the Plasticene

Tracking the global growth in plastic pollution

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refuse single-use plastic



### Plastics: the new coal in Appalachia?

[insideclimatenews.org](http://insideclimatenews.org) | Feb. 25

With the natural gas fracking boom, plastics production is spreading in the Ohio River Valley. But at what cost to health and climate?



### Maine could be among first in U.S. to ban plastic bags statewide

[pressherald.com](http://pressherald.com) | Feb. 24

With 20 communities already restricting them, and more on the way, the state may take California's environmental cue.



### Draft UK law seeks to create committee on plastic pollution

[businessgreen.com](http://businessgreen.com) | Feb. 24