Plastics in the Medical Setting: Avoiding Harm

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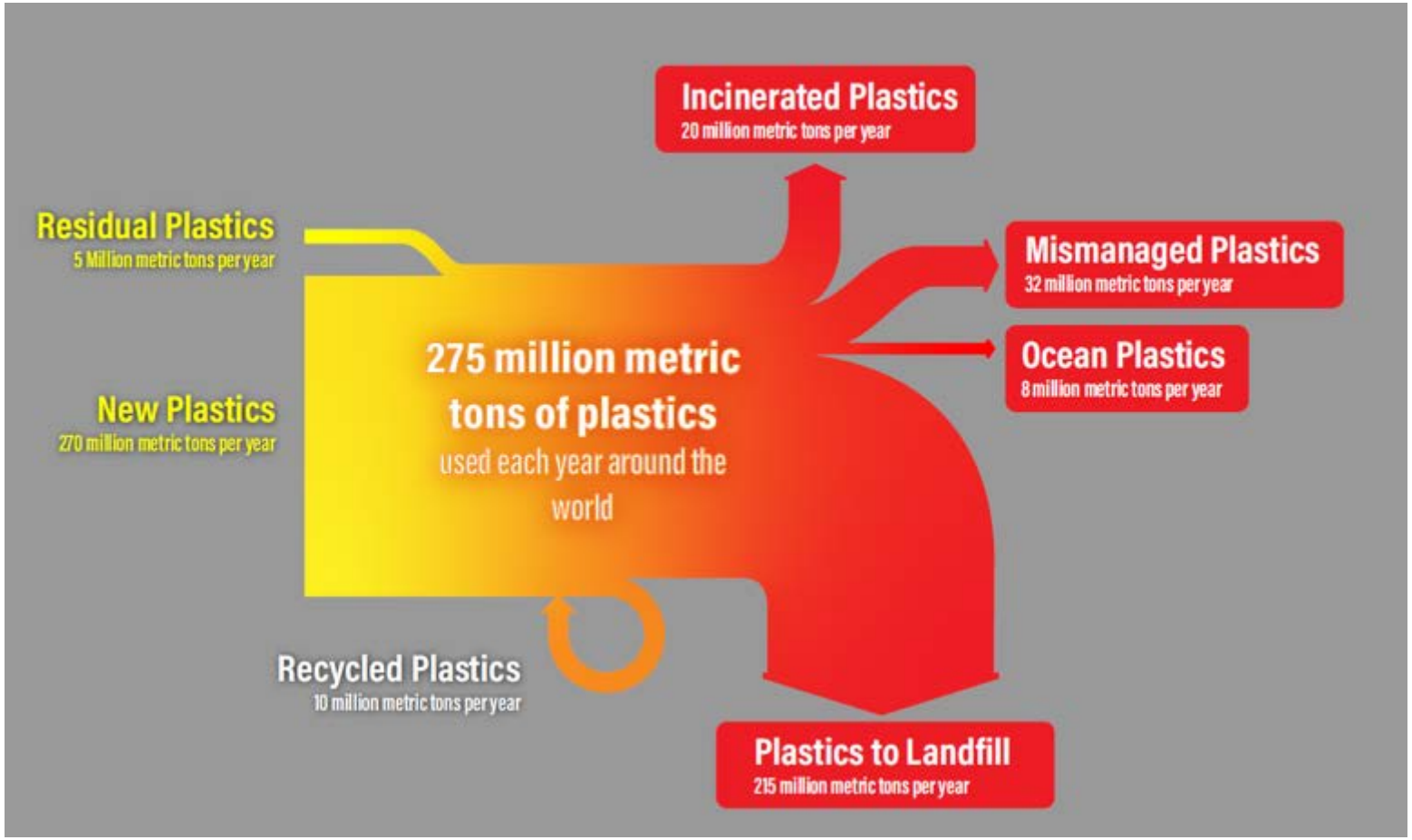
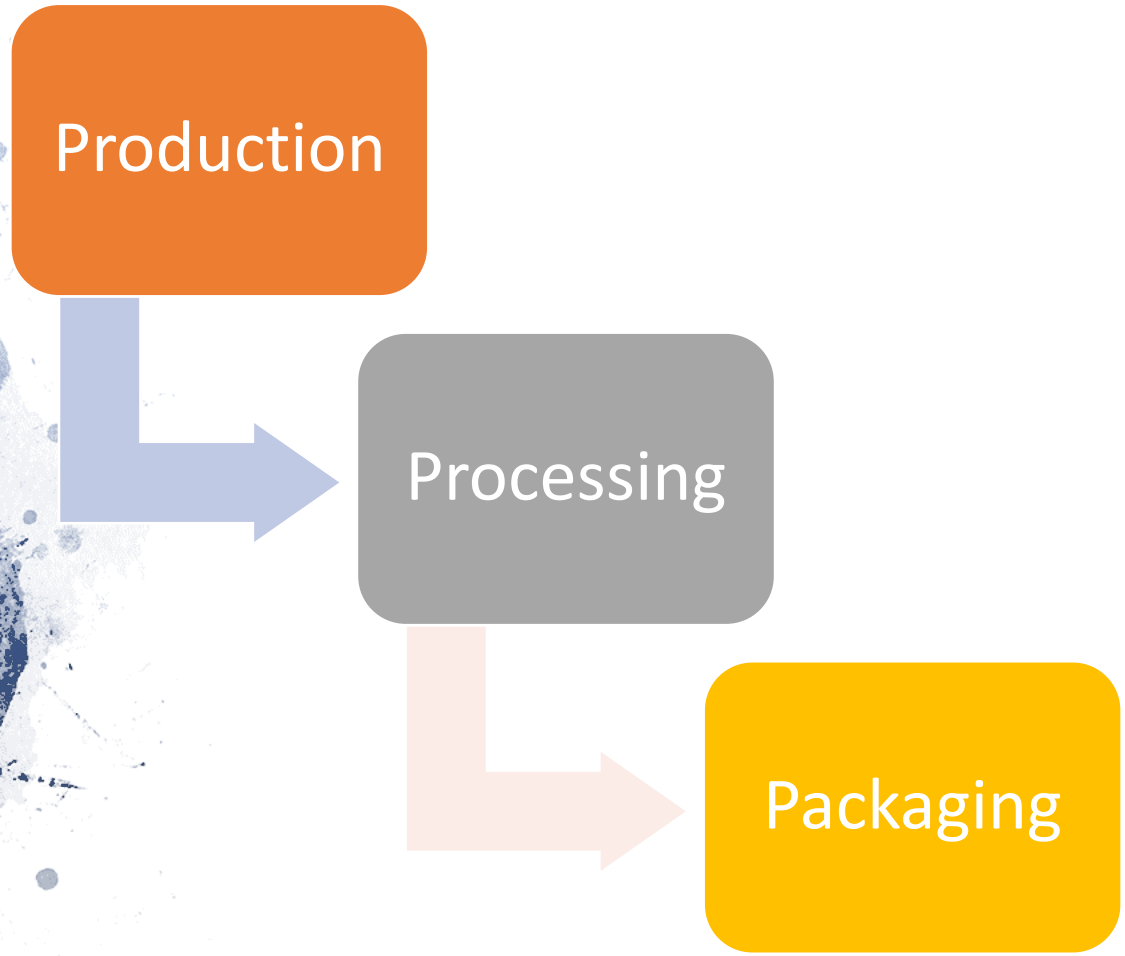
Plastics are all around us



Many of these chemicals are added un/intentionally to plastic medical equipment

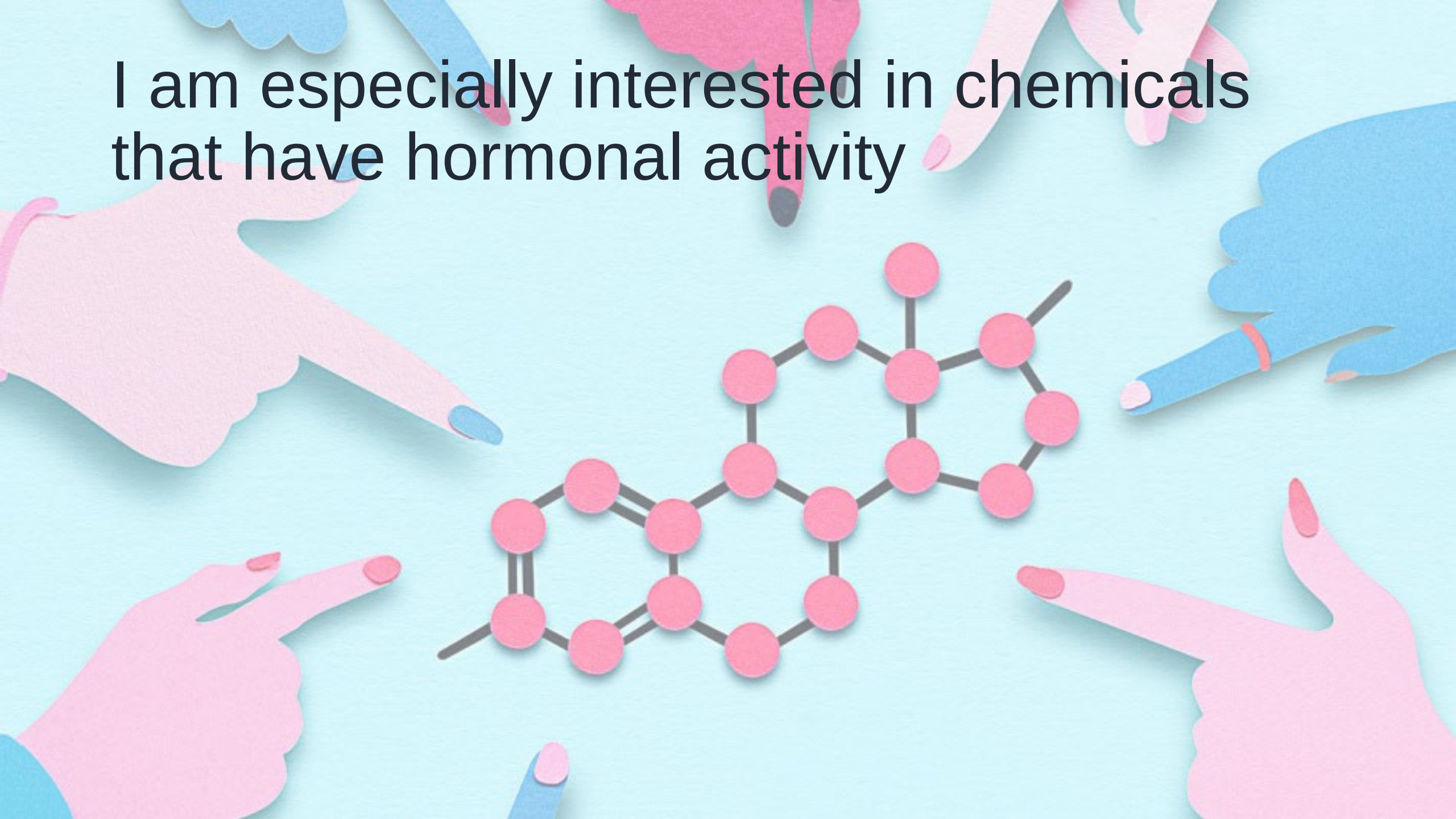


Plastic waste contaminates soil, water, air and the food chain

Reliance on plastics harms health

- Harmful chemicals used during production of plastic or as additives in plastic products
- Endocrine-disrupting chemicals from plastics block, mimic or otherwise interfere with the body’s hormones

I am especially interested in chemicals that have hormonal activity



EDCs in the medical setting

Equipment

Hard plastics

Flexible plastics

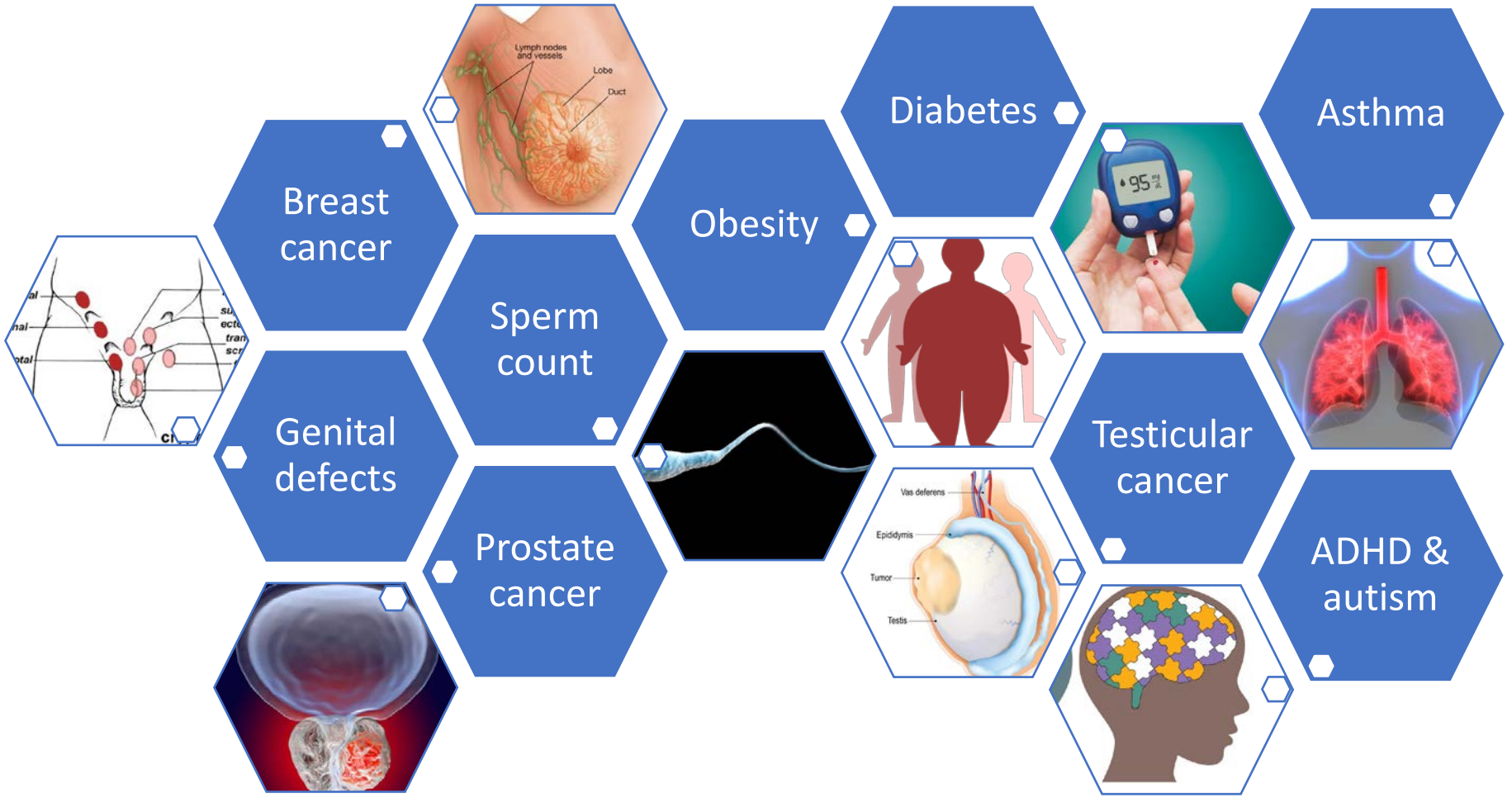
Absorbent papers & fibers

Drug coatings

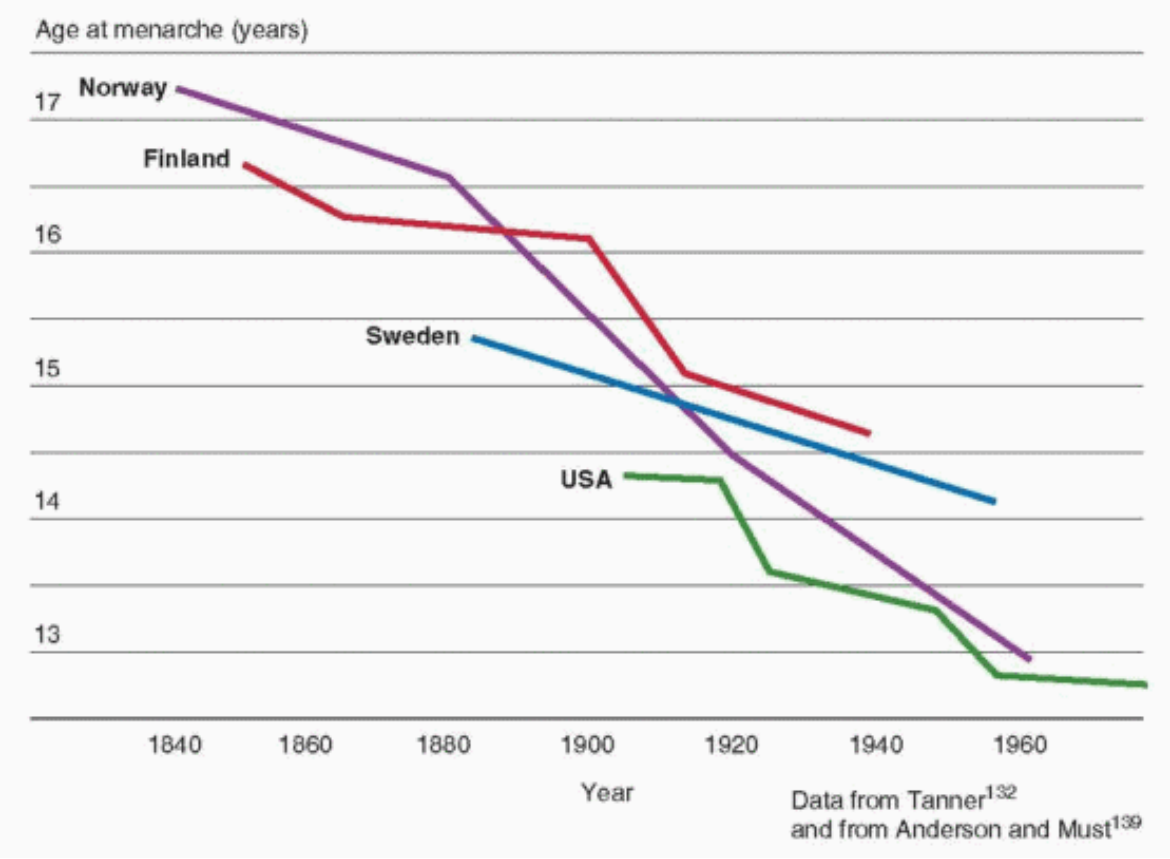
Lotions, soaps, detergents

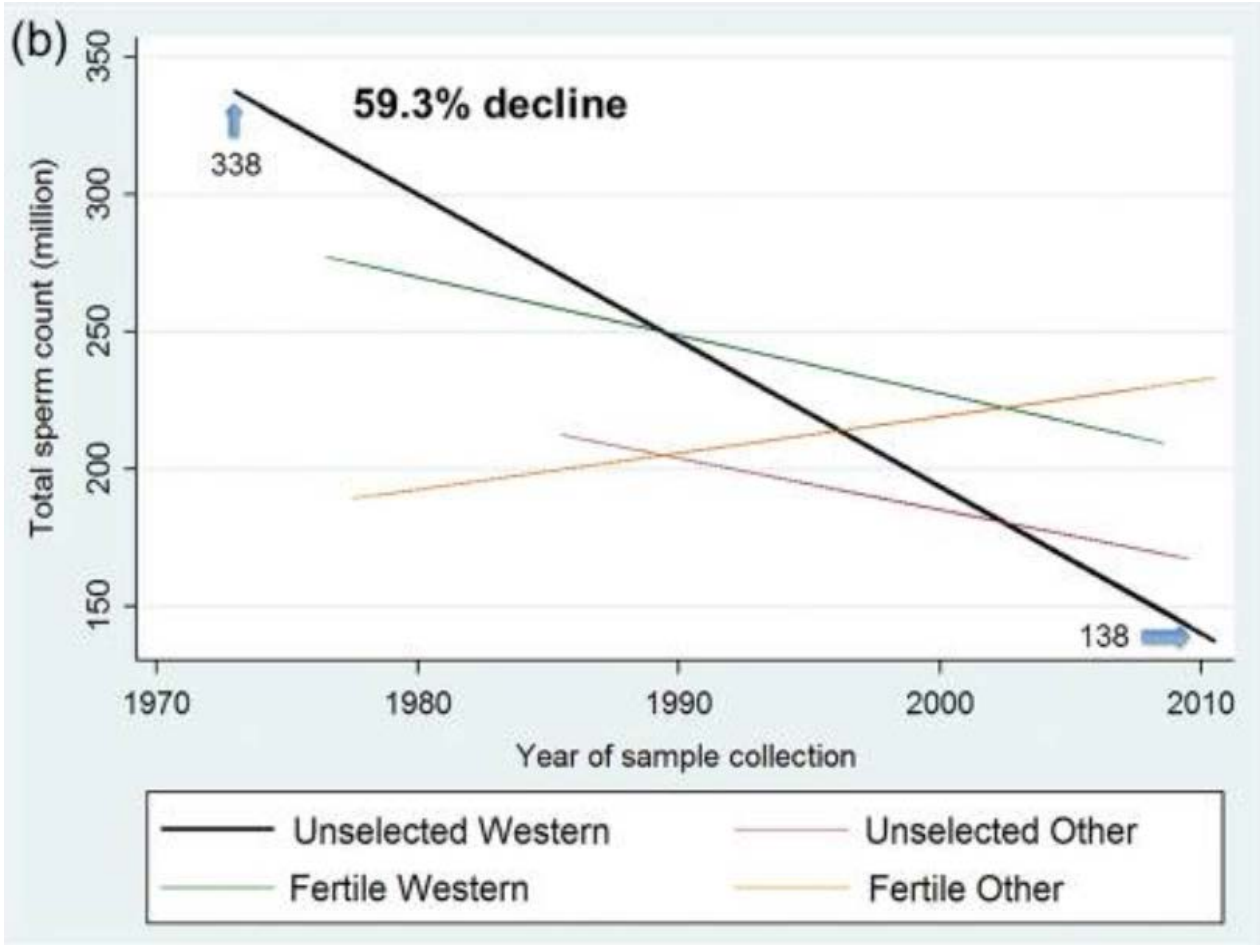
We often hear: “But we’ve all been exposed and we’re all fine!”

We are not fine. Hormone associated diseases/disorders on the rise:



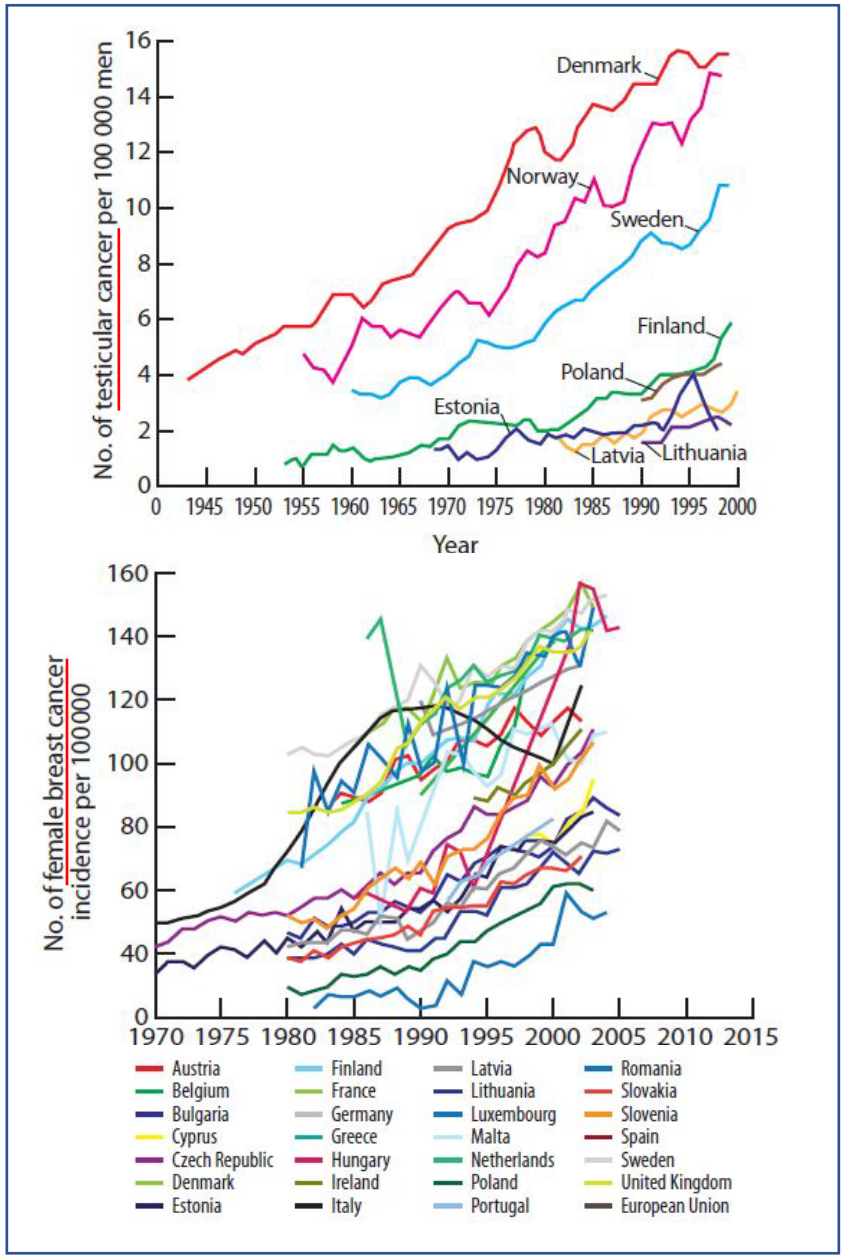
We are not fine





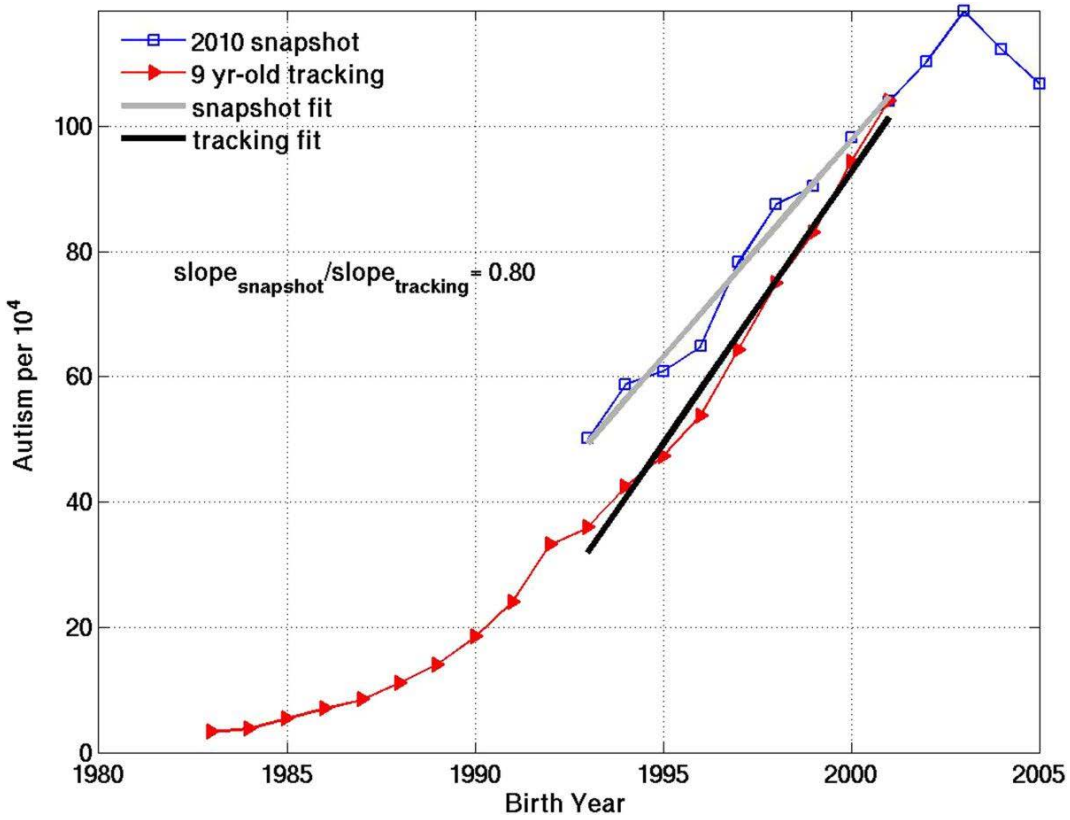
Left: Tanner, Anderson & Must
Right: Levine et al., Hum Reprod Update. (2017)

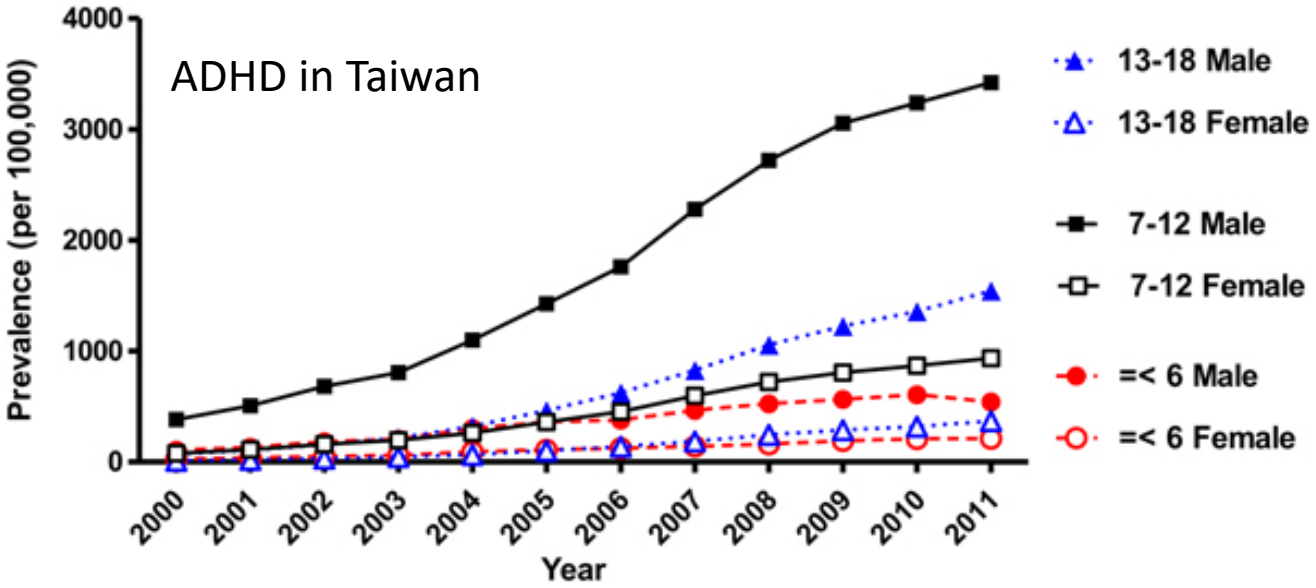
We are not fine



Top: Richiardi et al., Cancer Epidem. Biomark. (2004);
Bottom: based on data from http://data.euro.who.int/hfadb/

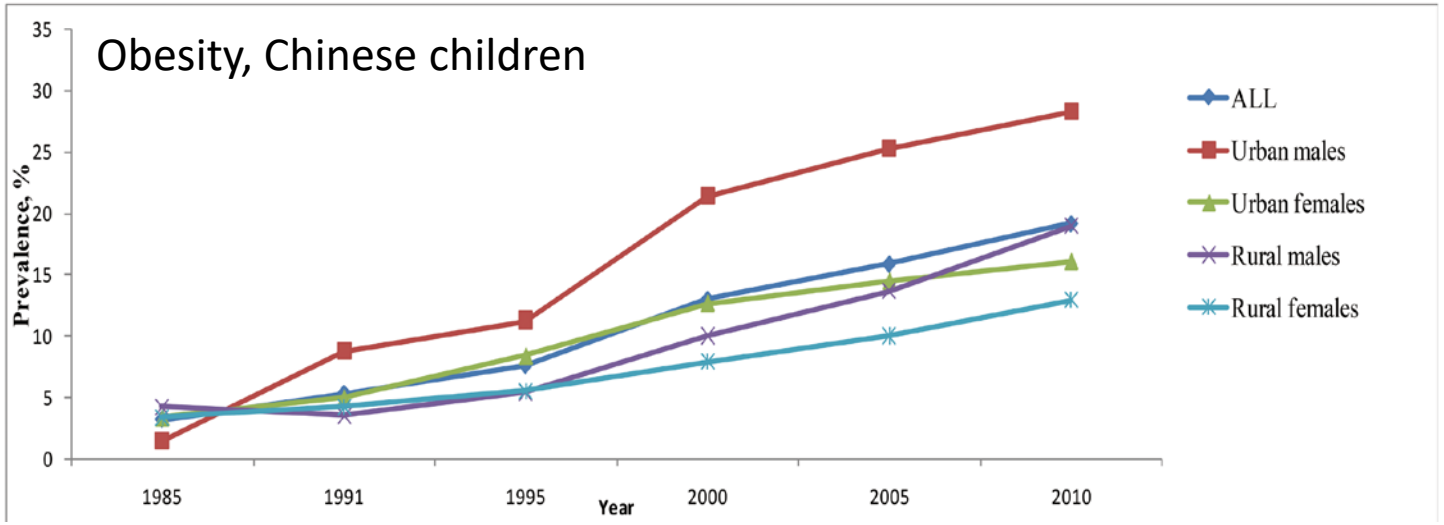
We are not fine



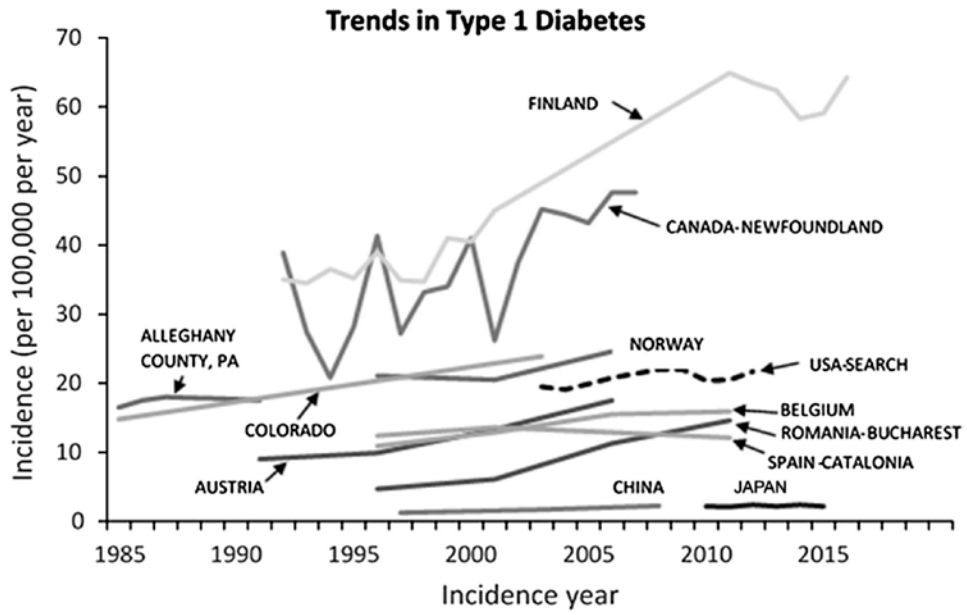


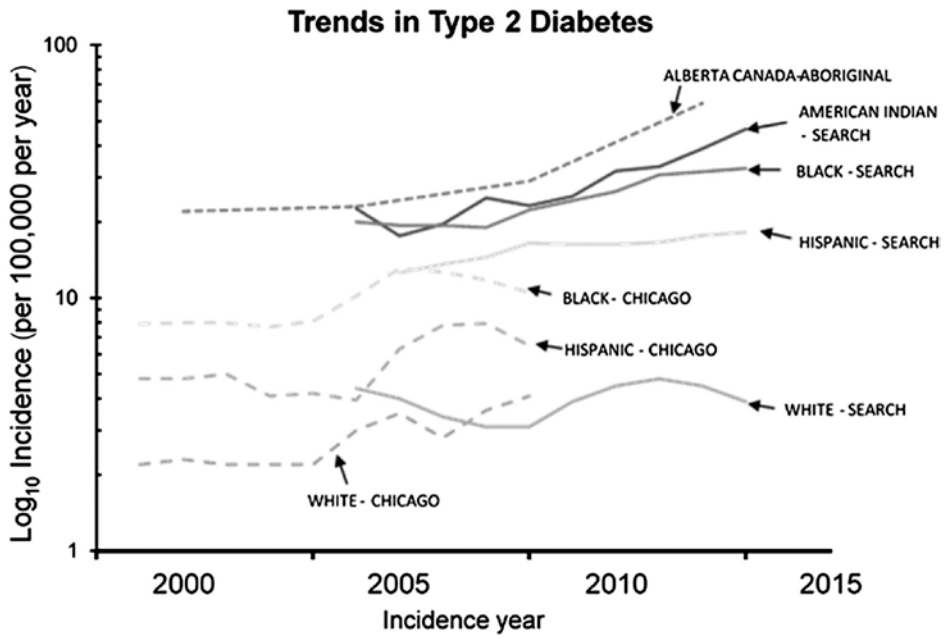
Left: Nevison, Environ Health (2014);
Right: Wang et al., Epidemiol & Psychiatry (2017)

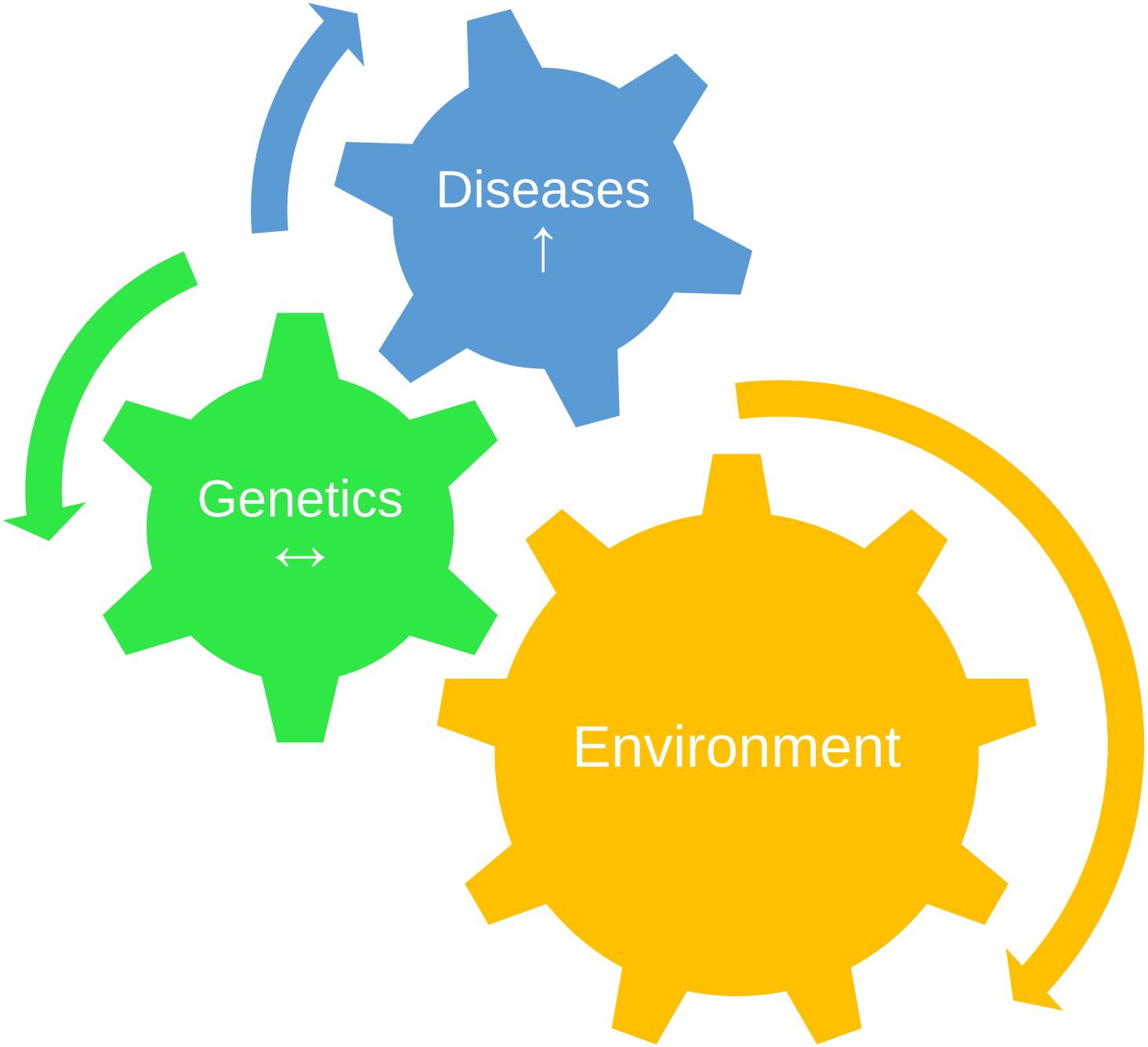
We are not fine



Top: Sun et al., PLoS One (2014);
Bottom (L&R): Dabelea, Diabetes Care (2018)






Diseases
↑
Genetics
↔
Environment

Data from lab animals & human studies suggest that environmental chemicals – including chemicals found in medical equipment & materials – can induce these diseases and others

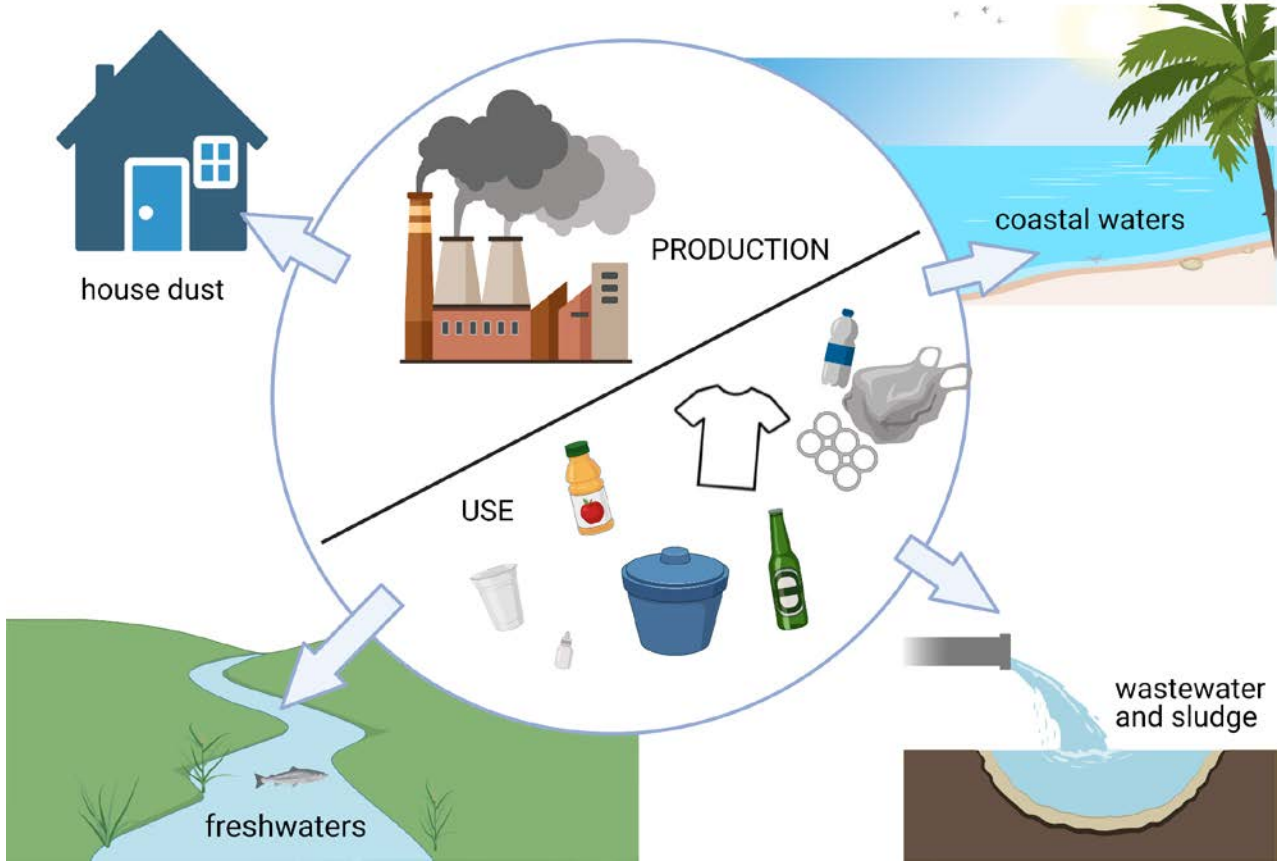
EDCs and disease

UV Stabilizers

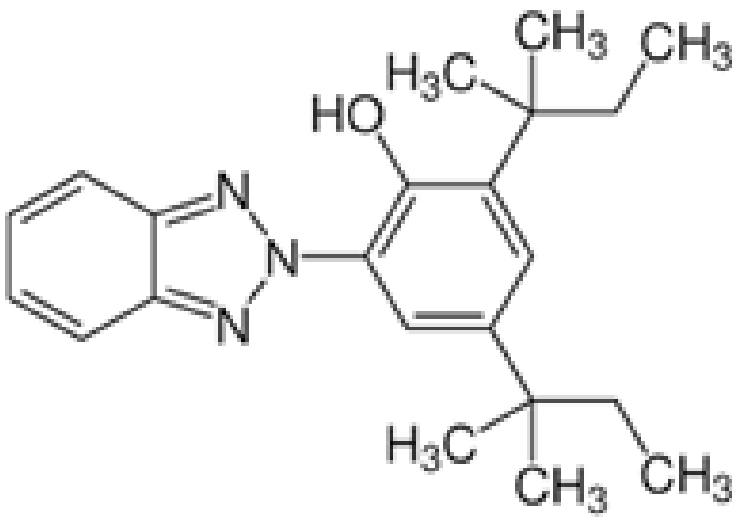
Added to products to protect against damage from harmful UV radiation; they also can prevent product fading, inhibit corrosion, and minimize fog

Found in:

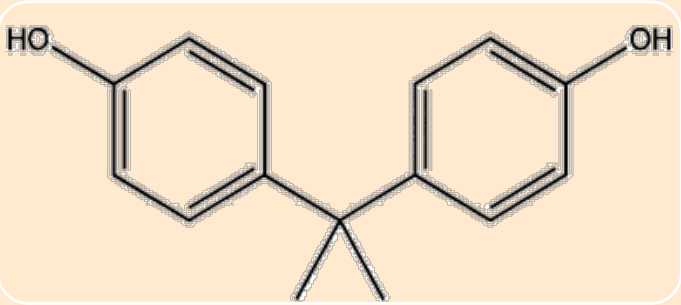
- Plastics
- Paints
- Building materials
- Other consumer goods



UV-328



- Environmentally persistent, proposed addition to the Stockholm Convention
- Measured in the bodies of wildlife and humans (breastmilk)
- Evidence of anti-androgenic behavior in cells



BPA

Canned foods & beverages

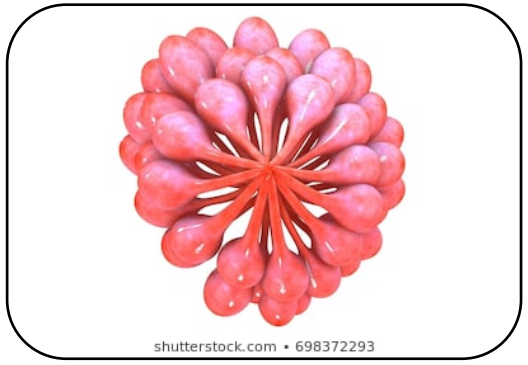
Consumer plastics

Thermal receipt paper

Sports & medical equipment

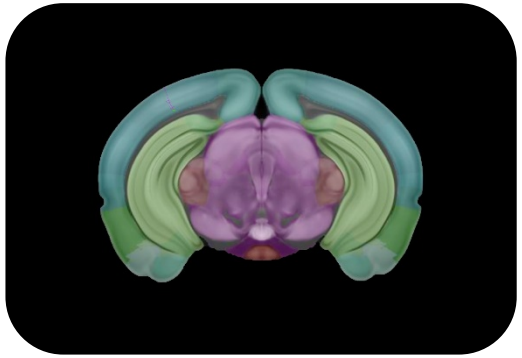
BPA’s effects on hormone-sensitive outcomes are well documented

Reproduction

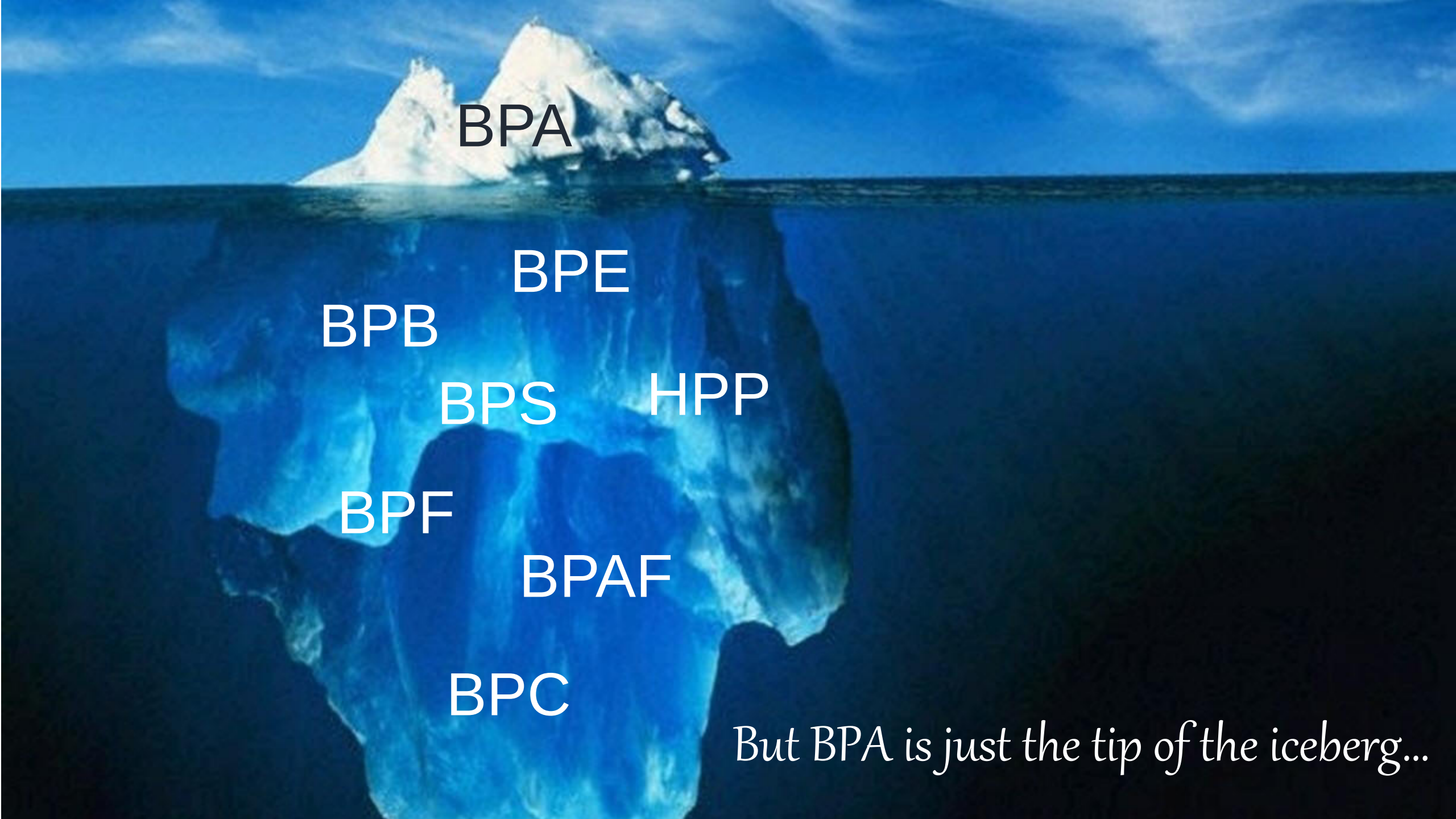


Mammary gland

Metabolic endpoints

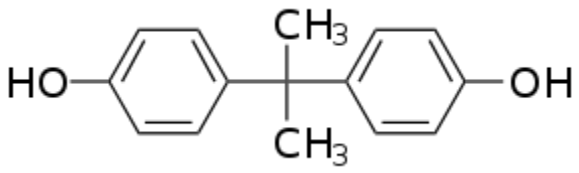


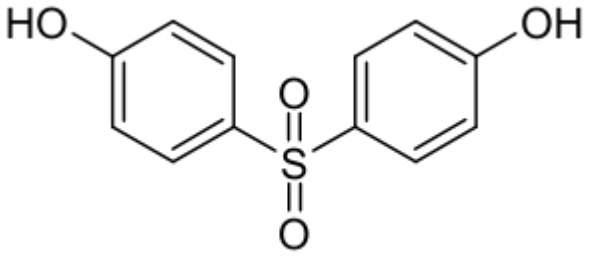
Brain & behavior

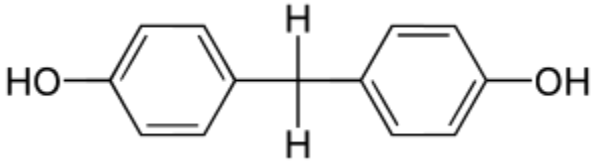

BPA
BPE
BPB
BPS
HPP
BPF
BPAF
BPC
But BPA is just the tip of the iceberg...

BPA Substitutes

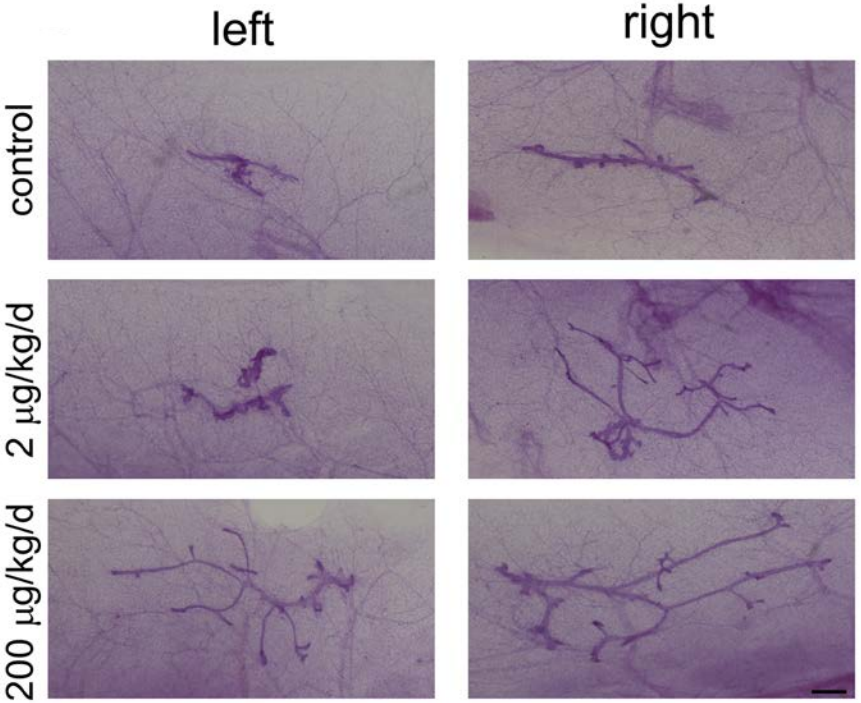
- Related chemicals have similar effects
  - Manufacturers using BPS, BPF, and other substitutes

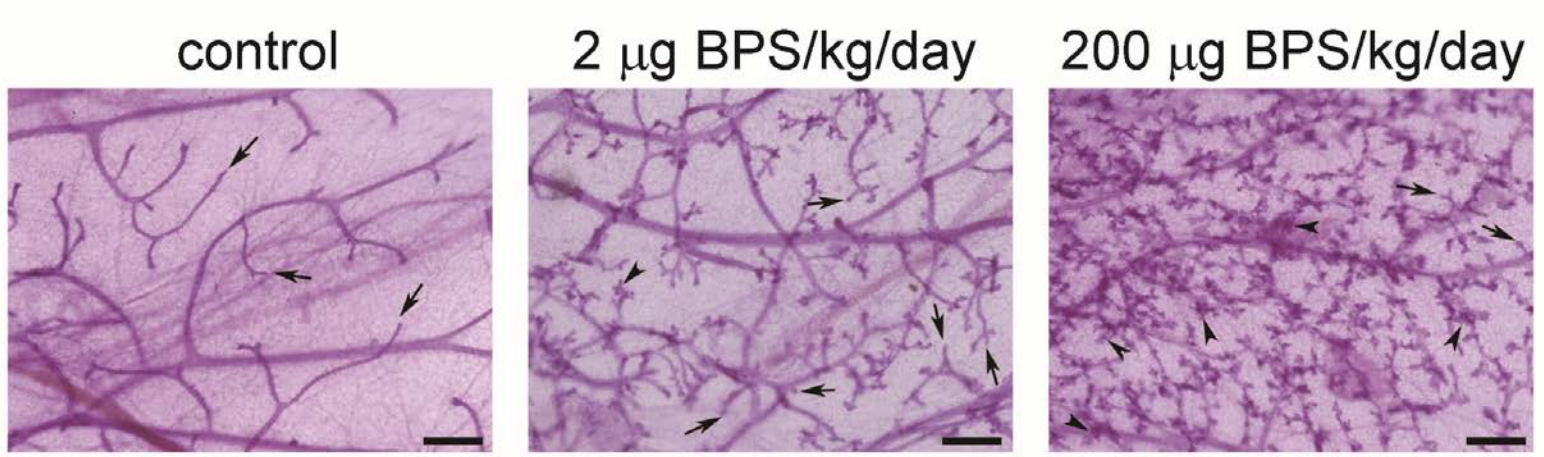






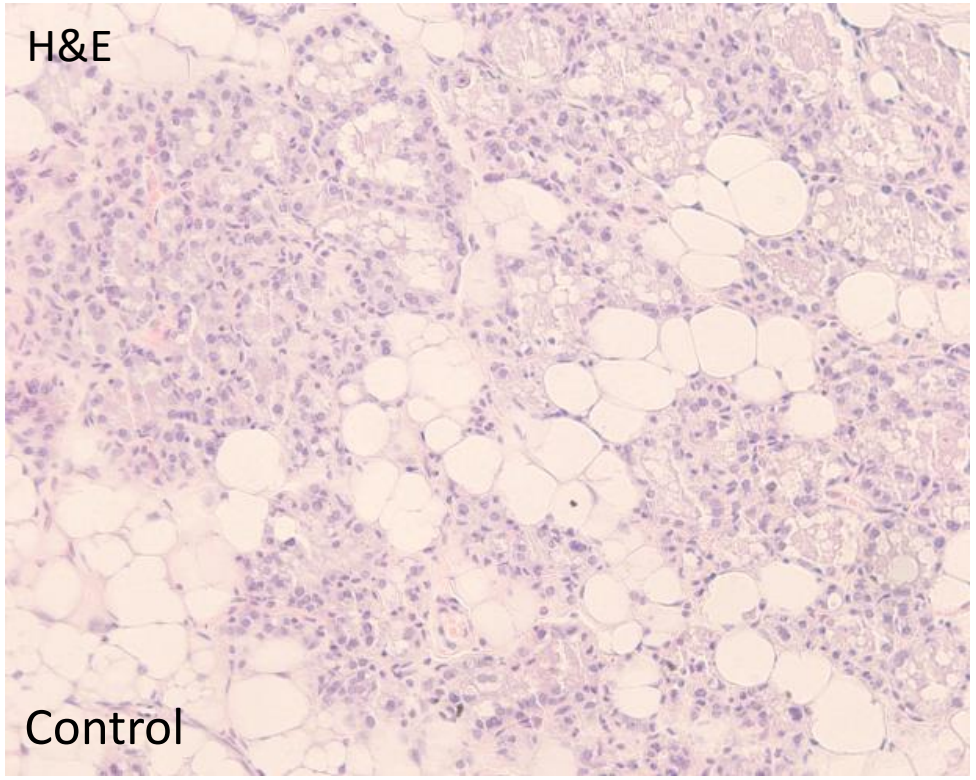
Work from my group has shown that BPS exposures alter mammary gland development in offspring (male and female)

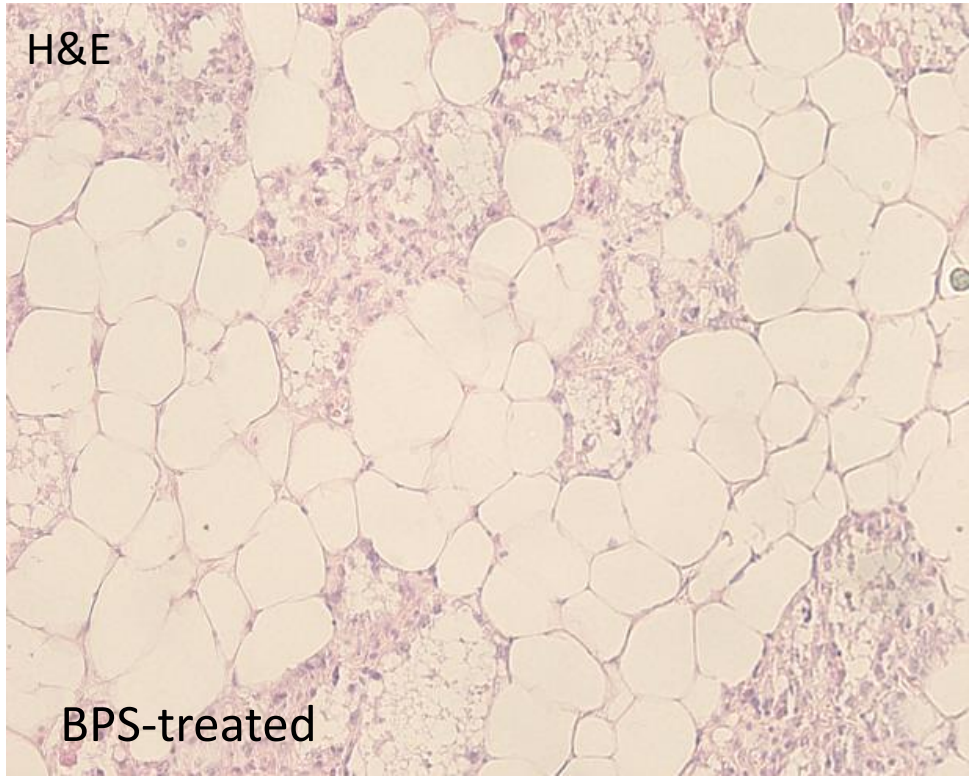




Kolla et al. Repro Tox 2018; Kolla et al. Toxicology 2019

BPS exposures alter mammary gland function in exposed mothers





LaPlante et al. Endocrinology 2017; Pokharel (in prep)

Phthalates

Promote flexibility and to reduce brittleness in plastics

Used in:

- PVC products
- Personal care products
- Fillers in medications and dietary supplements
- Food and beverage packaging
- Children’s toys
- Medical tubing

Phthalates’ Health Effects

- Reduce testosterone and estrogen levels
- Identified as reproductive toxicants
- Block thyroid hormone action
- Linked to diabetes and obesity

Alkylphenols

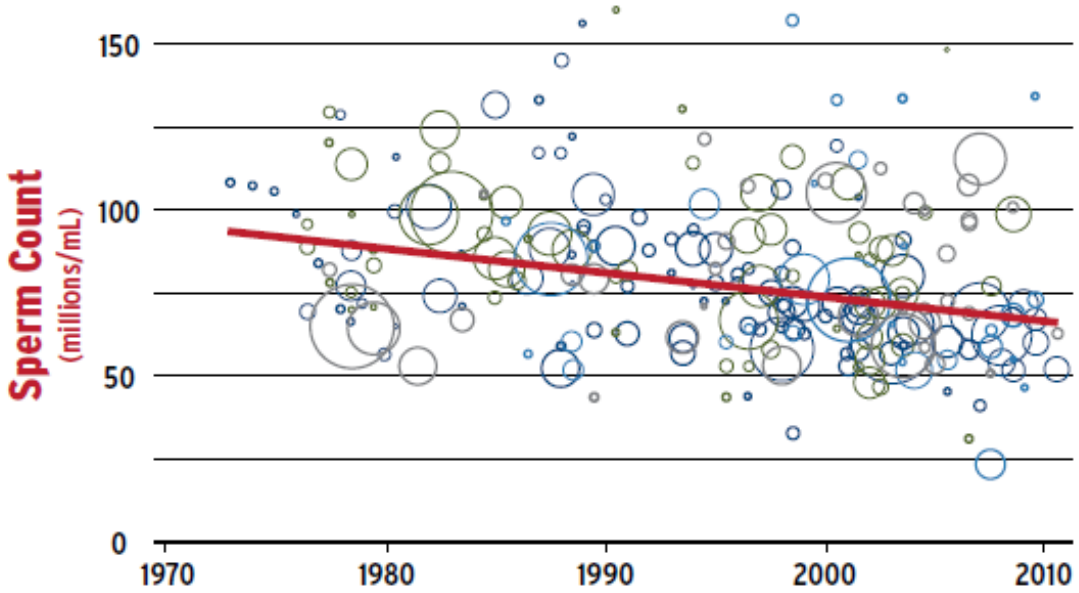
Commonly used in:

- Latex paints
- Pesticides
- Industrial cleaners
- Detergents
- Personal care products
- Plastics

Alkylphenols' Health Effects

Linked to:

- Male infertility
- Low sperm count
- Disrupts prostate development
- Male cancers
- Female and male breast cancers among those with occupational exposures



Perfluorinated compounds

“Forever chemicals” found in:

- Water and stain-resistant clothing
- Food contact wrappers
- Lubricants
- Carpet treatments
- Paints
- Cookware
- Dispersant in fire-fighting foams

PFAS and PFOA’s Health Effects

- Disrupt immune systems, liver, blood lipids and thyroid function
- Lower birth weight
- Alter puberty
- Raise breast cancer risk
- Associated with kidney, testicular, prostate, and ovarian cancers, and non-Hodgkin’s lymphoma

Brominated flame retardants

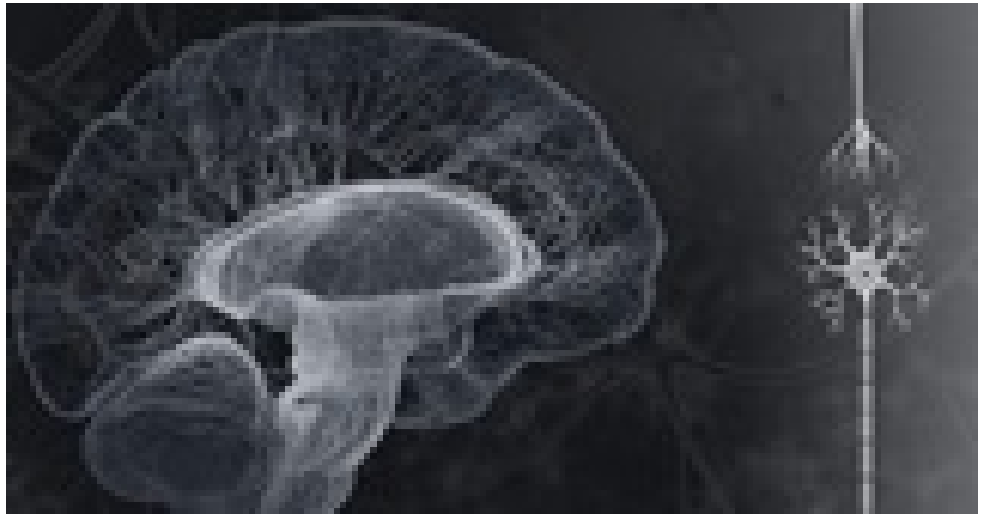
Reduce flammability of plastic products

Found in:

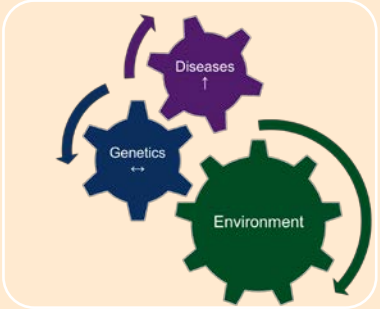
- Electronics casings
- Textiles
- Furniture foams
- Carpets
- Building materials
- Plastic children’s toys
- Recycled plastics

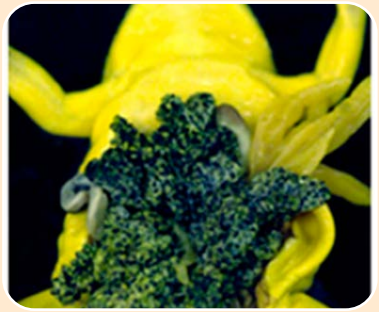
BFR’s Health Effects

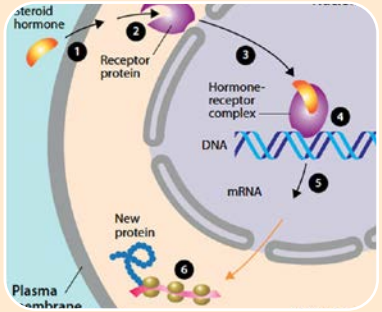
- Disrupt male and female reproductive development
- Alter thyroid development
- Affect neurodevelopment



There is a strong case that chemicals in plastics & other medical products can affect human health







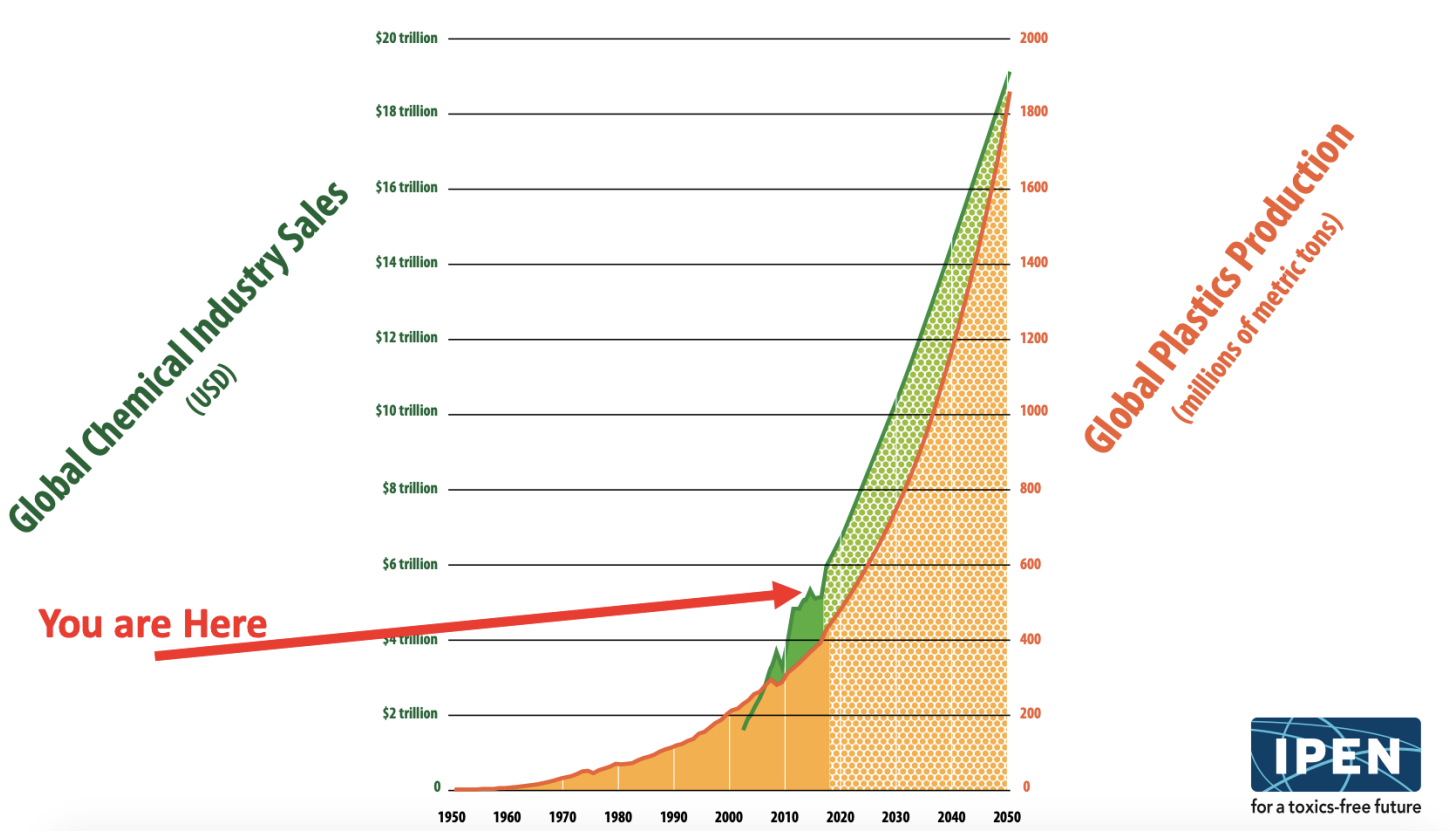
Even low exposures to EDCs can induce adverse health effects

Human and animal studies support causal relationships between EDCs & disease

Many endocrine diseases are increasing in prevalence

Animal studies have helped to identify the mechanisms by which EDCs cause harm

Plastics and chemicals production set to increase

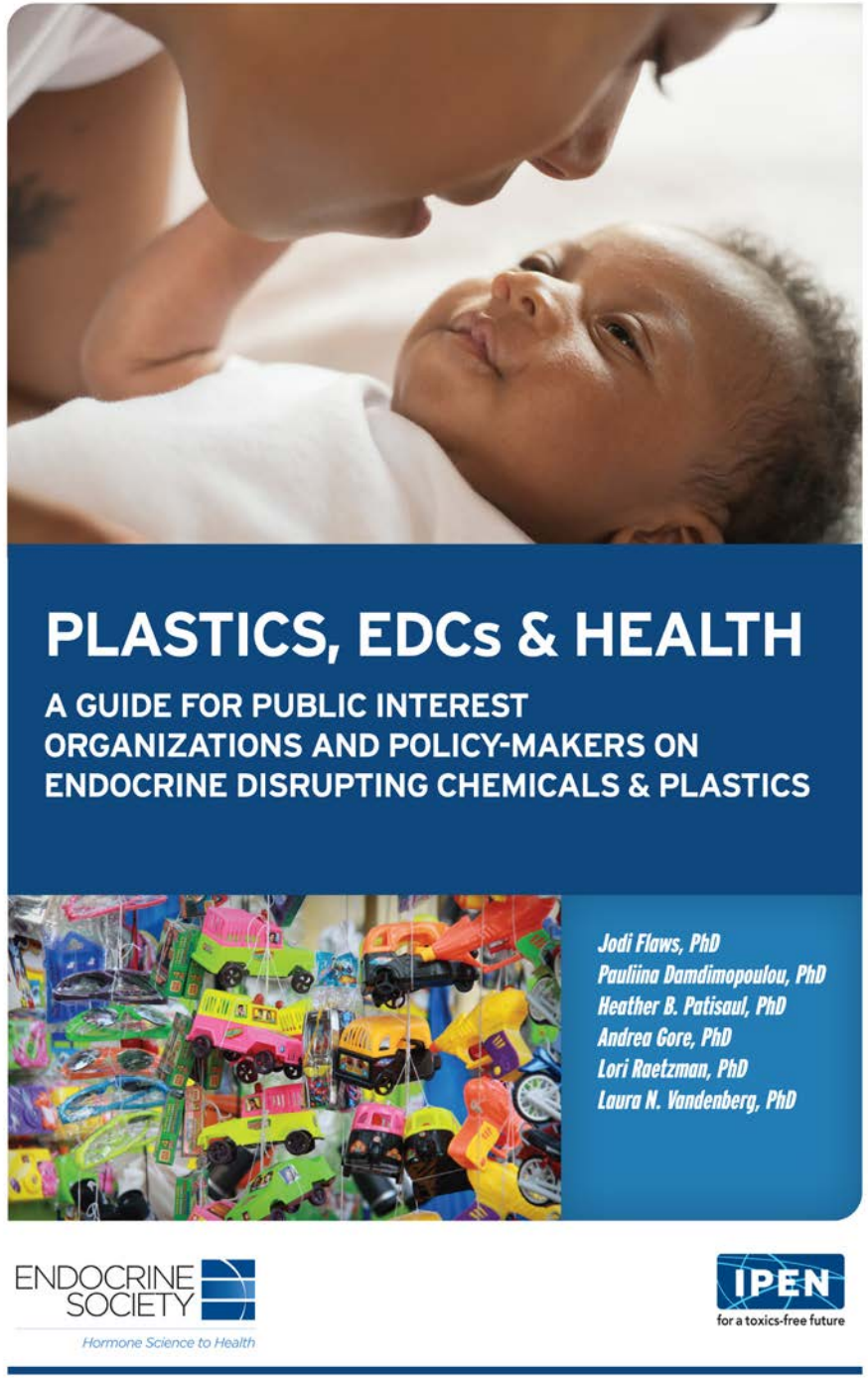


Read more…

Available from:

https://www.endocrine.org/news-and-advocacy/news-room/2020/plastics-pose-threat-to-human-health

https://www.endocrine.org/-/media/endocrine/files/topics/edc_guide_2020_v1_6bhqen.pdf



Thank you to my co-authors

- Dr. Jodi Flaws (University of Illinois – Urbana Champaign, US)
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