

Chronic Diseases Associated with Food Packaging Chemical Exposure

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Humans are exposed
to chemicals from
numerous sources

Metals

Industrial
Chemicals

Personal
care
products

Pesticides

Detergents

Plastics

Drugs:
prescribed
&
recreational

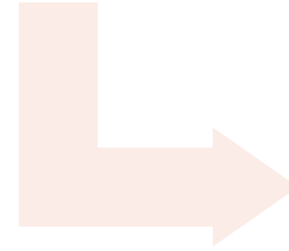
Air &
Water
Pollution

Many of these
chemicals end
up in the food
supply

Production

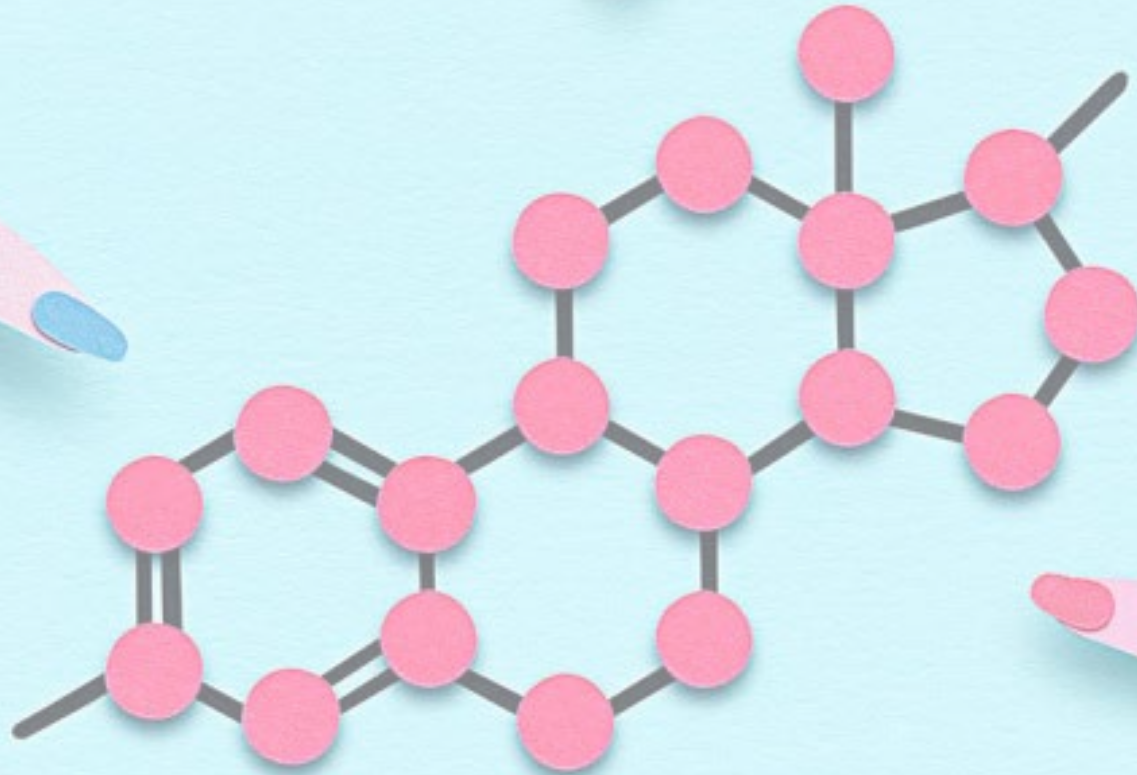


Processing



Packaging

I am especially interested in chemicals that have hormonal activity



Daily exposures to many of these chemicals are typically low – and often unsuspected



Bisphenols



Perchlorate



Benzophenones



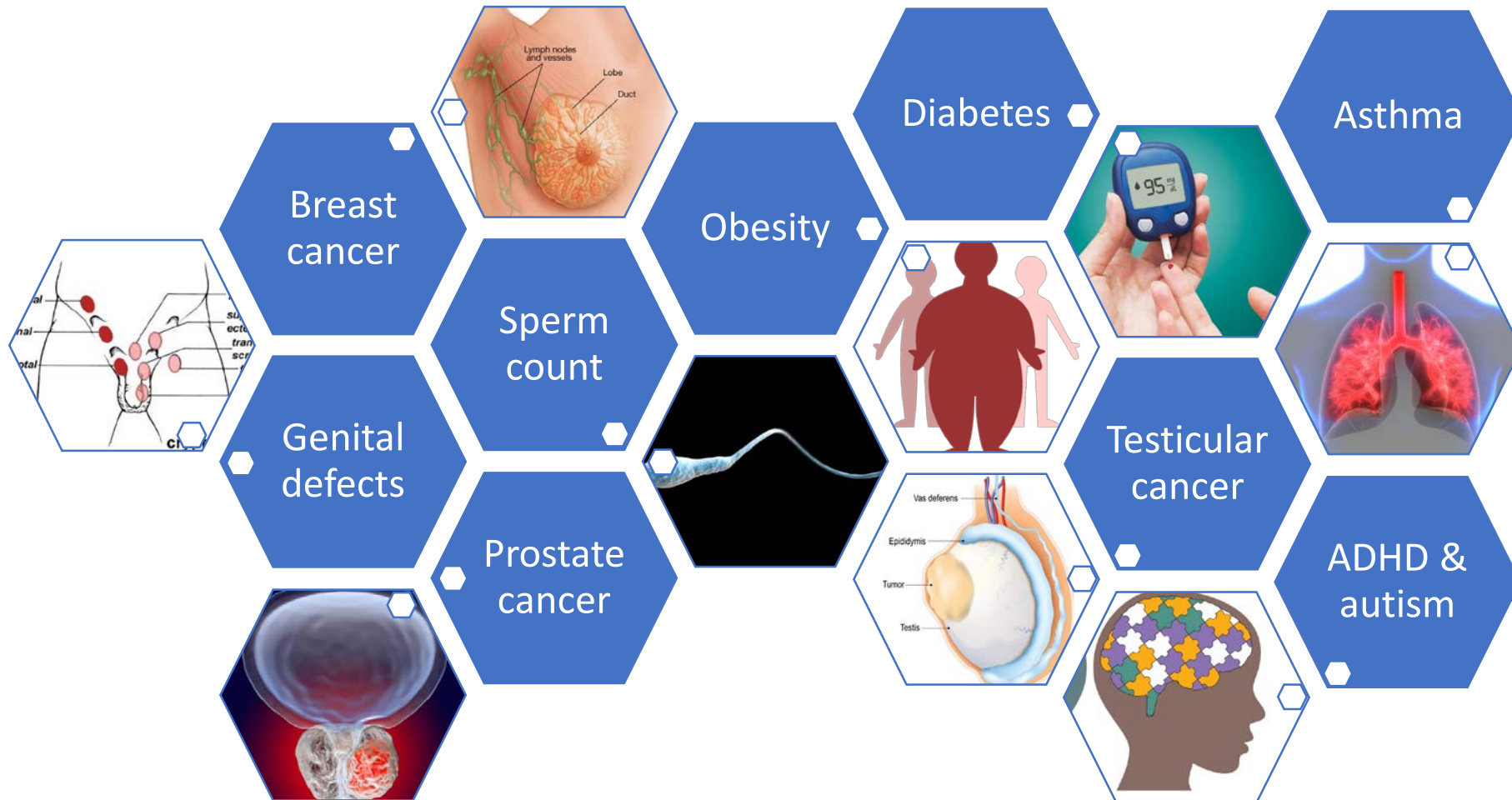
PFAS



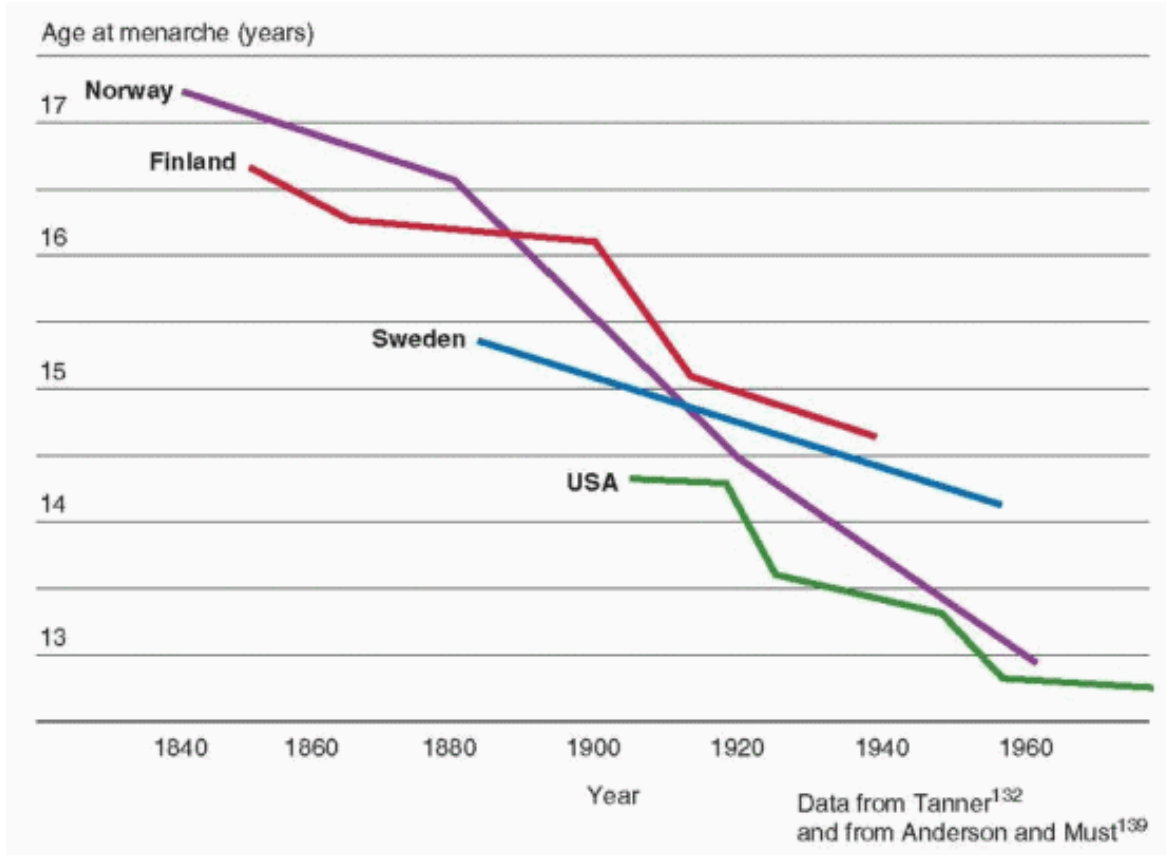
Parabens

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:

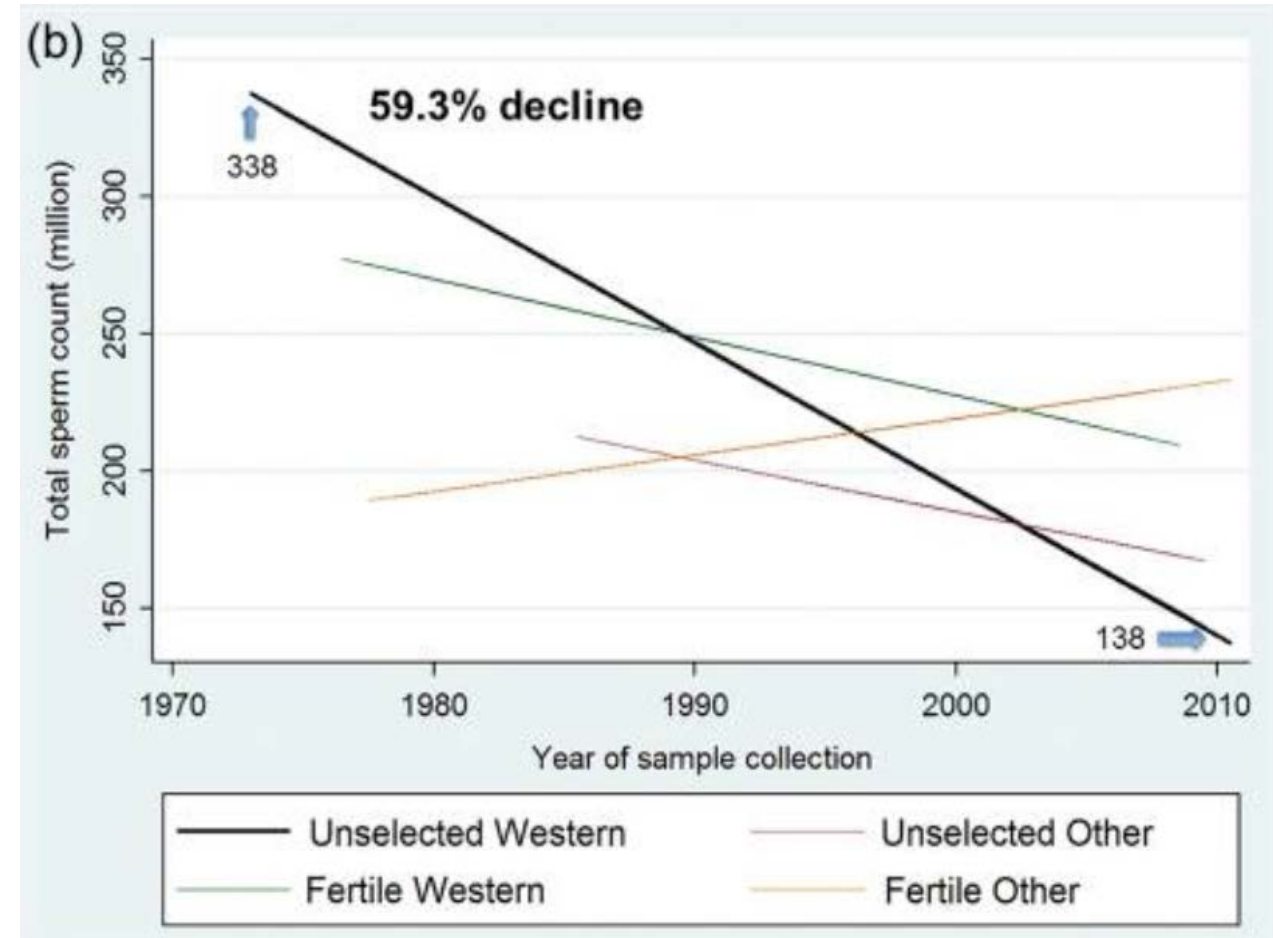


We are not fine

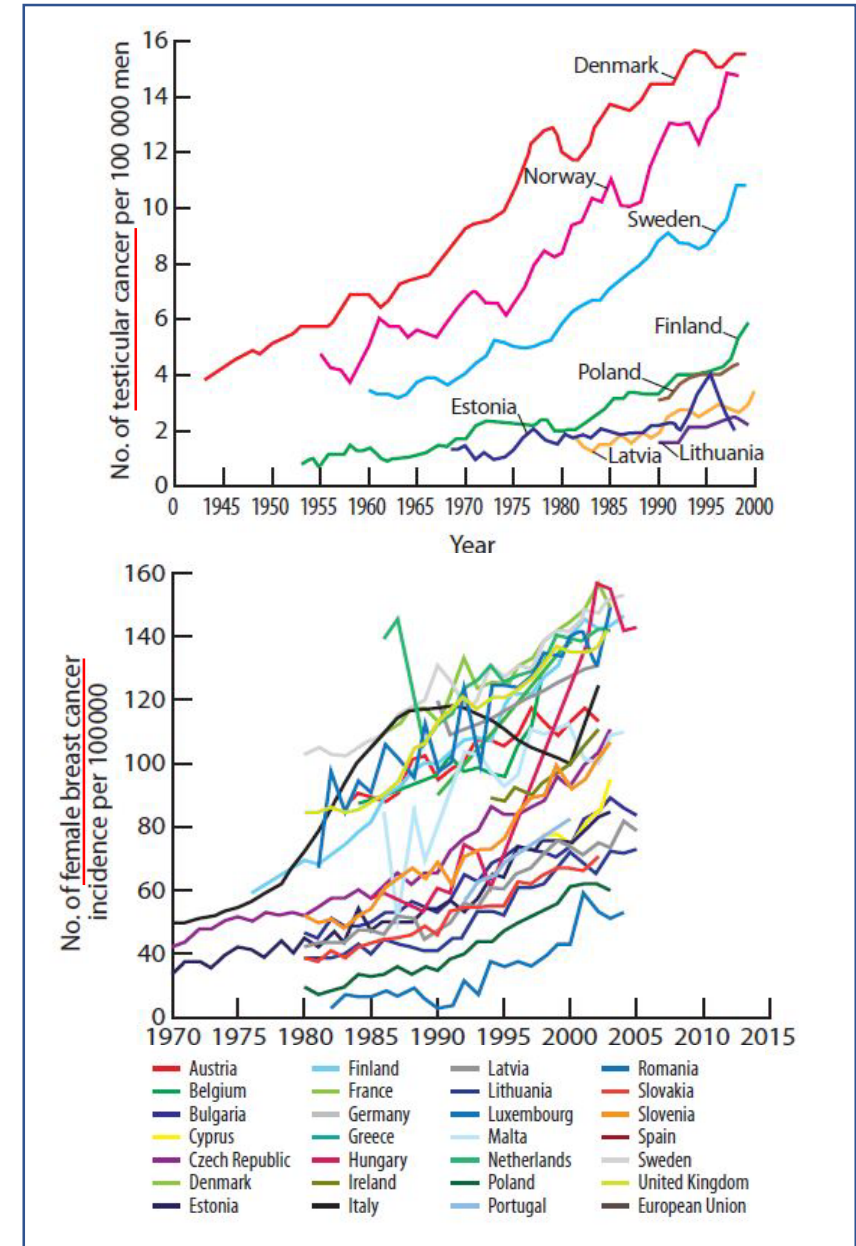


Left: Tanner, Anderson & Must

Right: Levine et al., Hum Reprod Update. (2017)

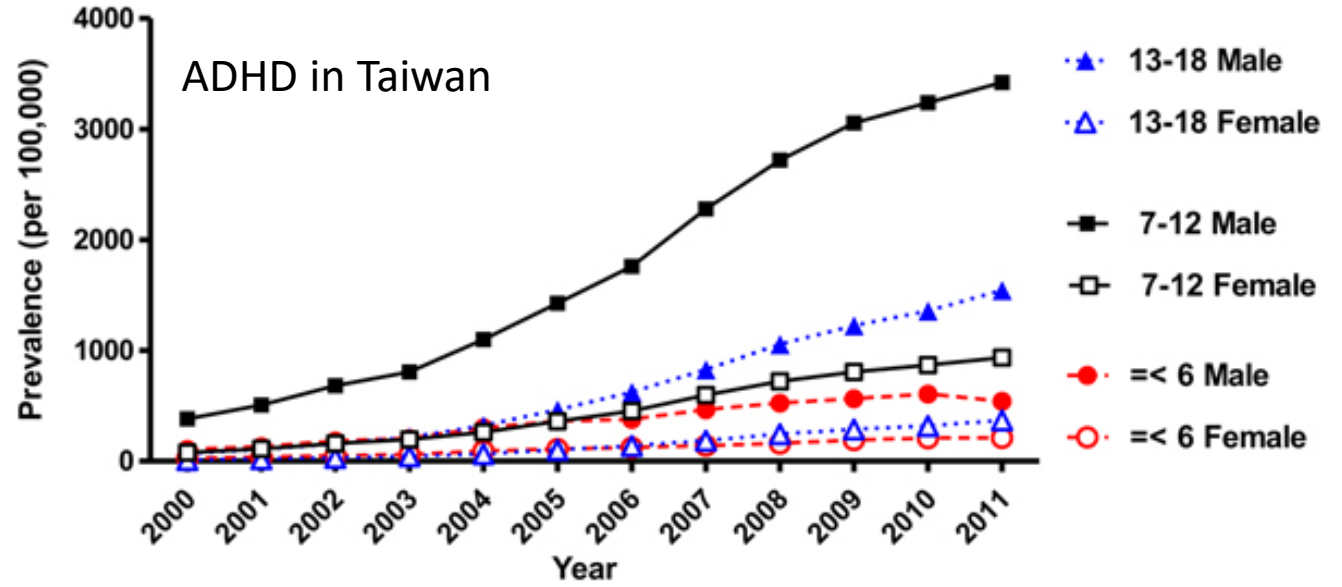
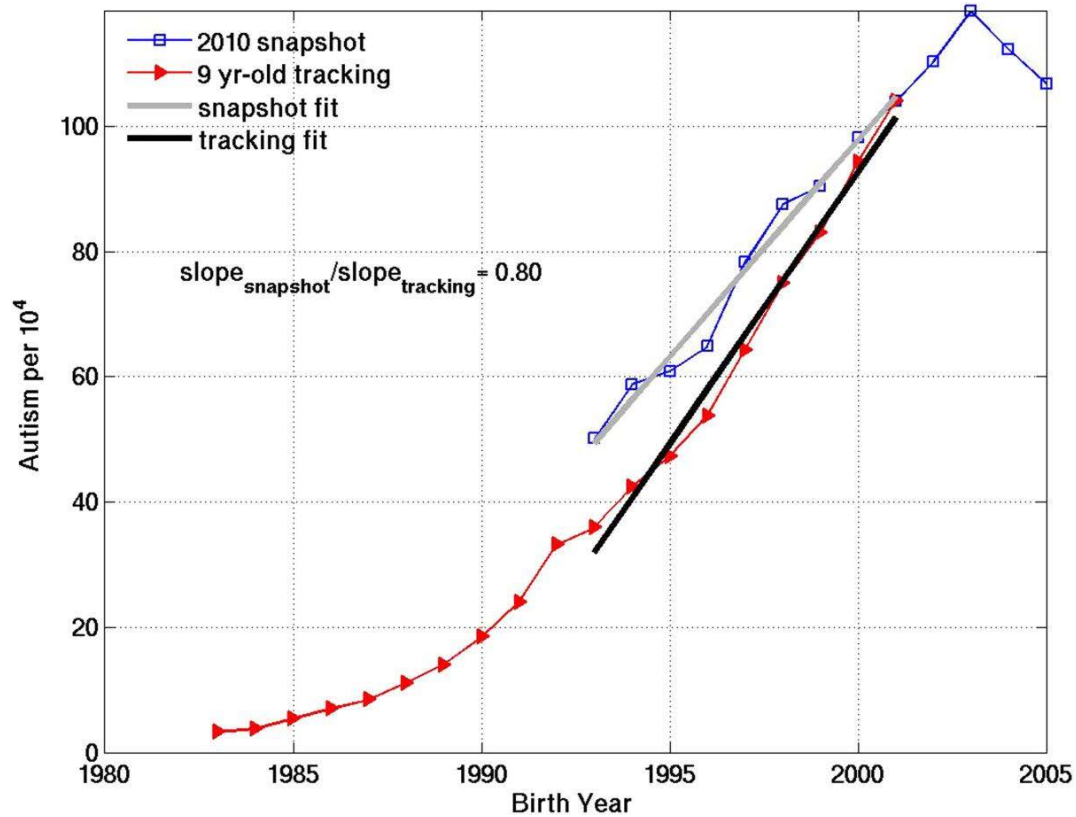


We are not fine



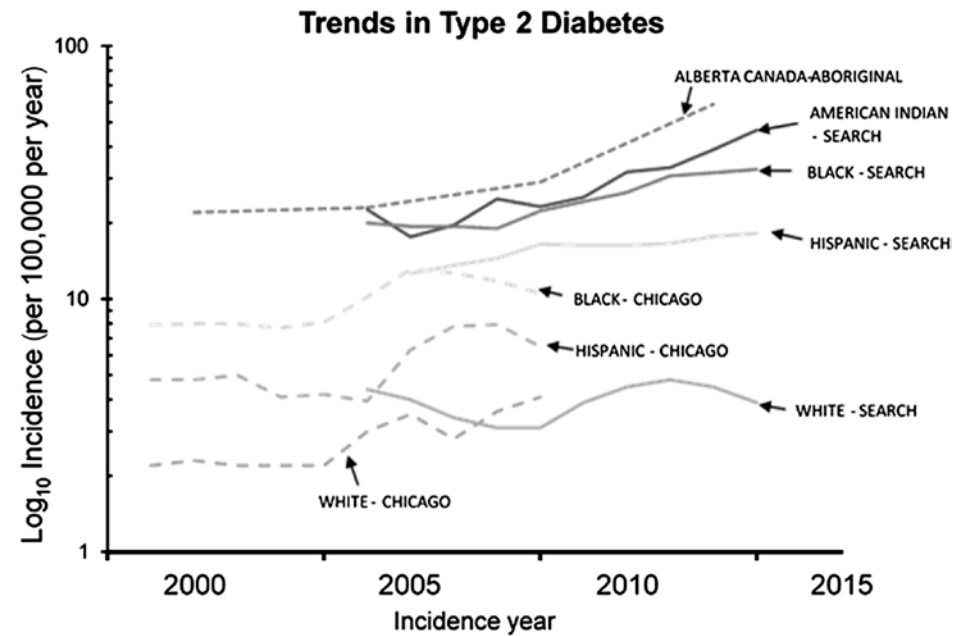
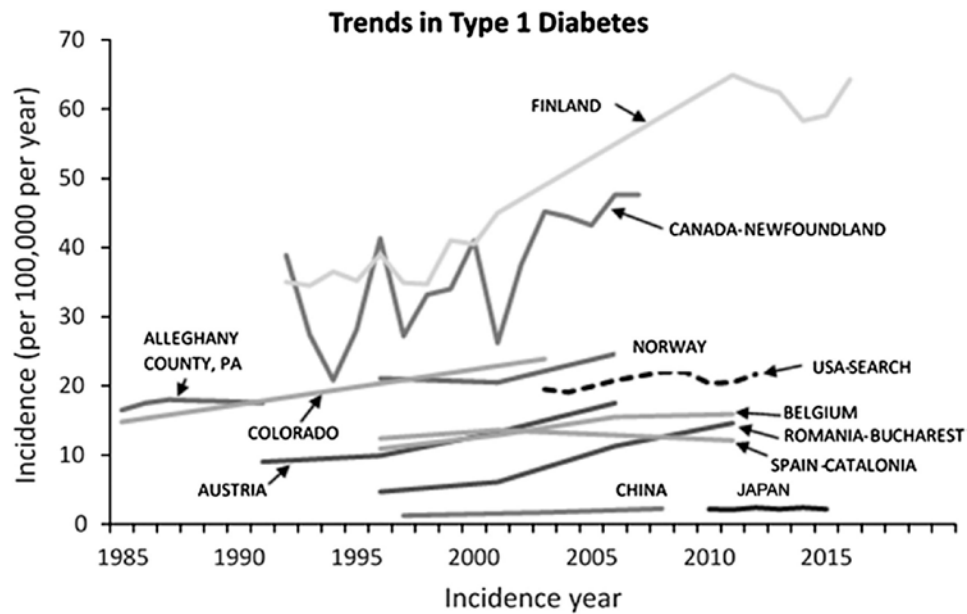
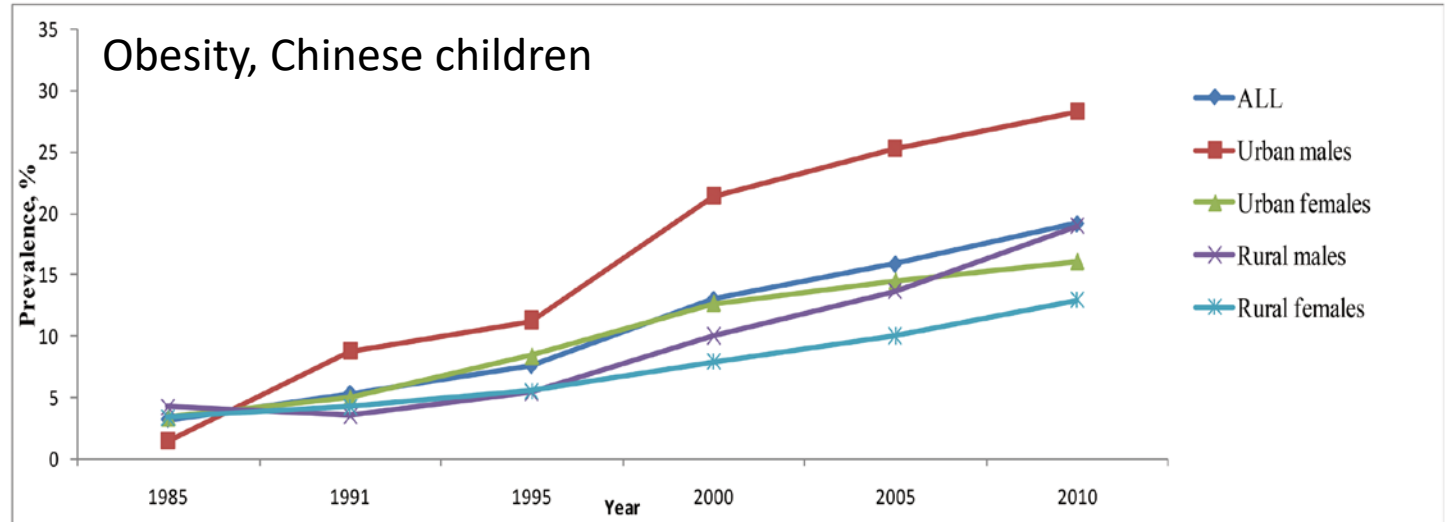
Top: Richiardi et al., Cancer Epidem. Biomark. (2004);
Bottom: based on data from <http://data.euro.who.int/hfad/>

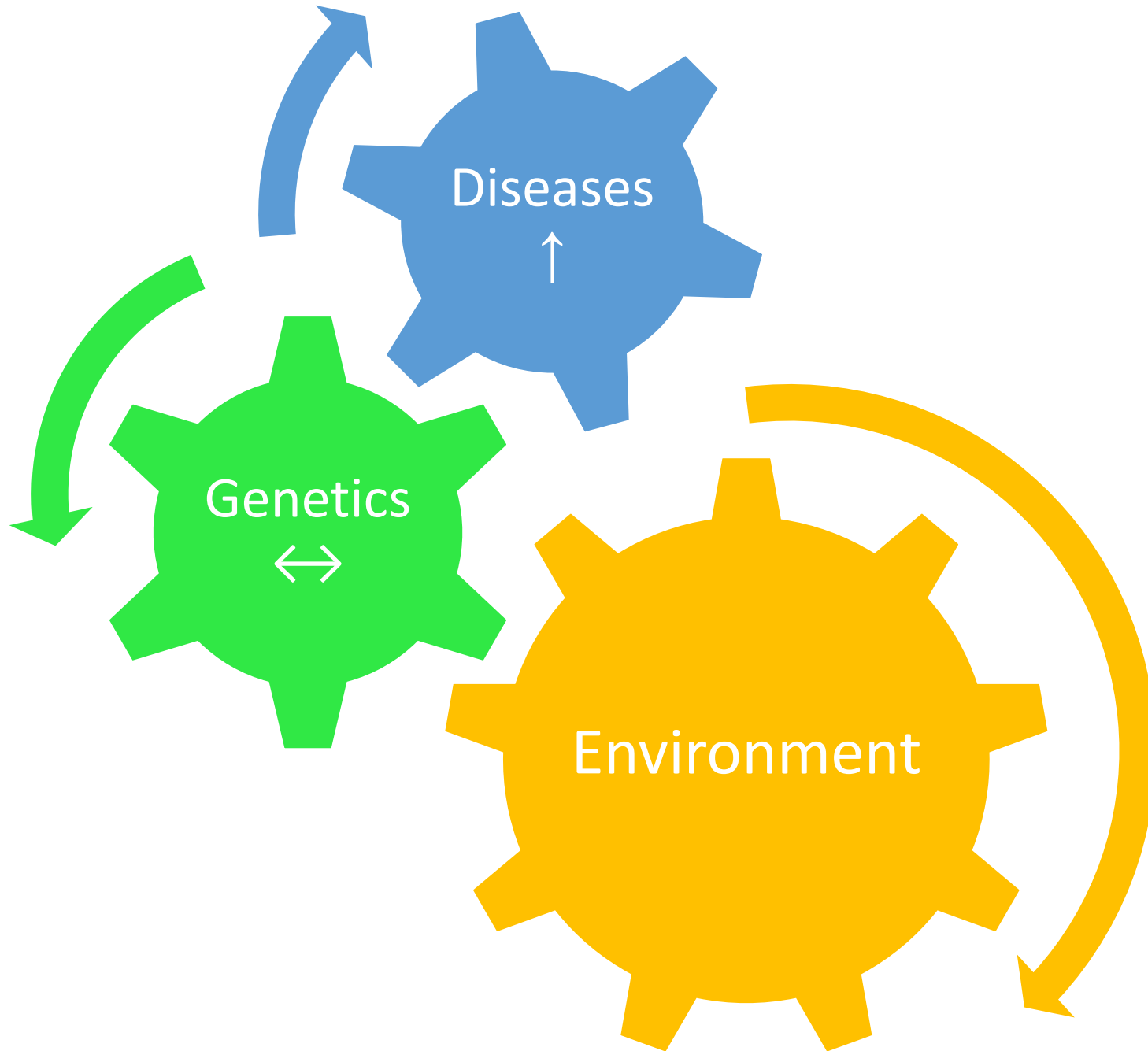
We are not fine



We are not fine

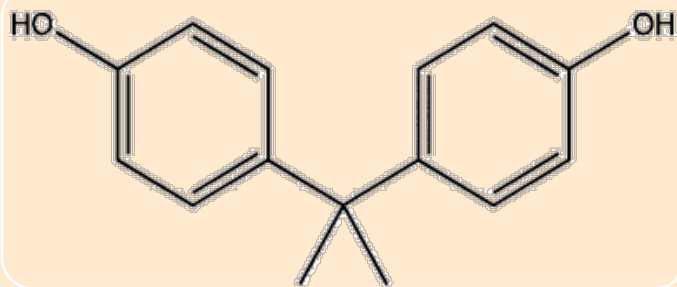
Top: Sun et al., PLoS One (2014);
 Bottom (L&R): Dabelea, Diabetes Care (2018)





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

Food Packaging chemicals and disease



BPA



Canned foods & beverages

Consumer plastics



Thermal receipt paper

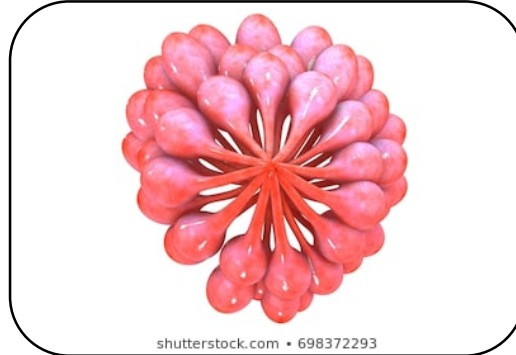
Sports & medical equipment



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



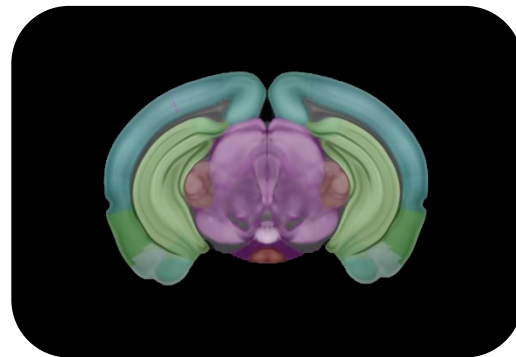
Reproduction



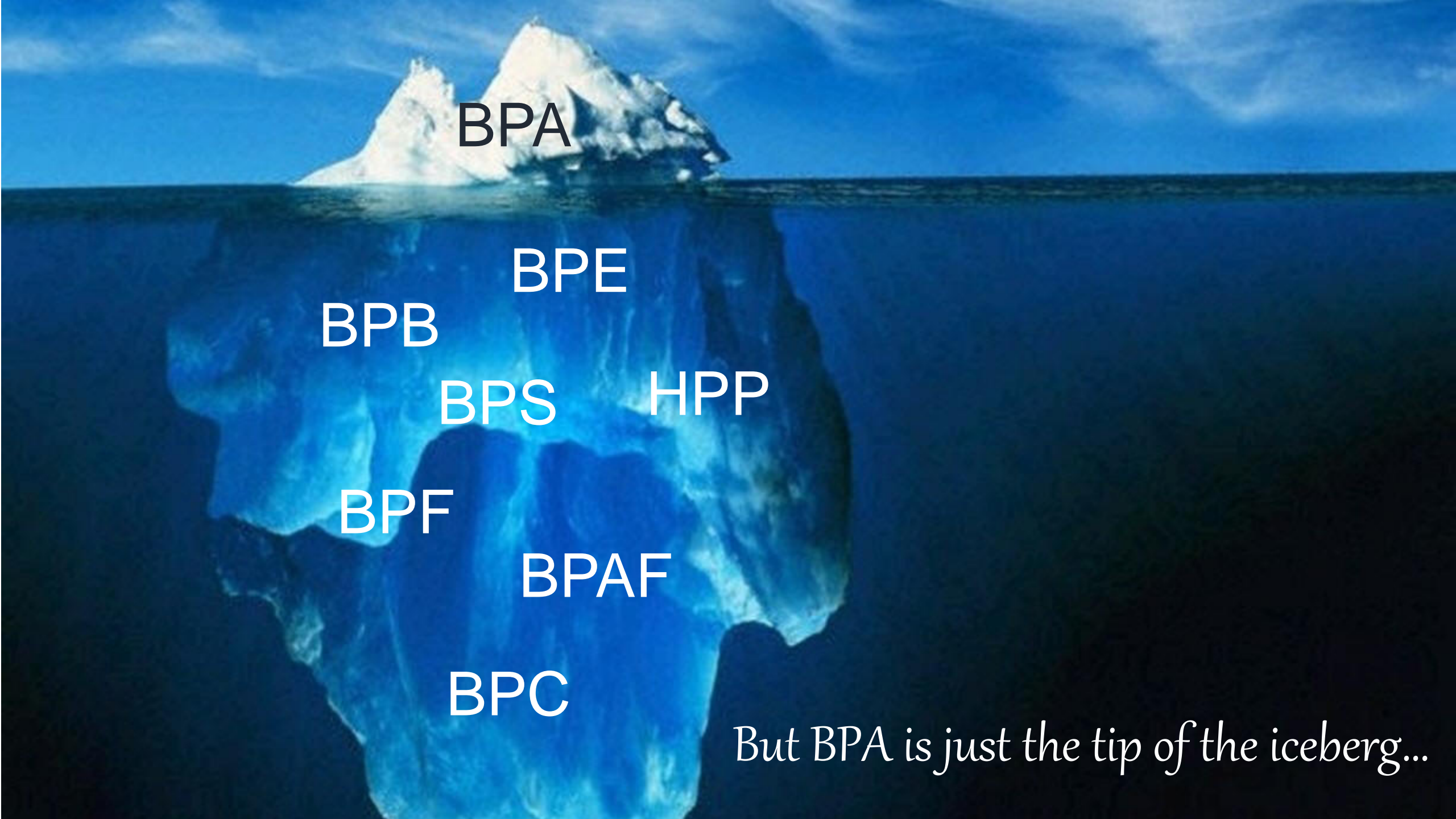
Mammary
gland



Metabolic
endpoints



Brain &
behavior



BPA

BPE

BPB

BPS

HPP

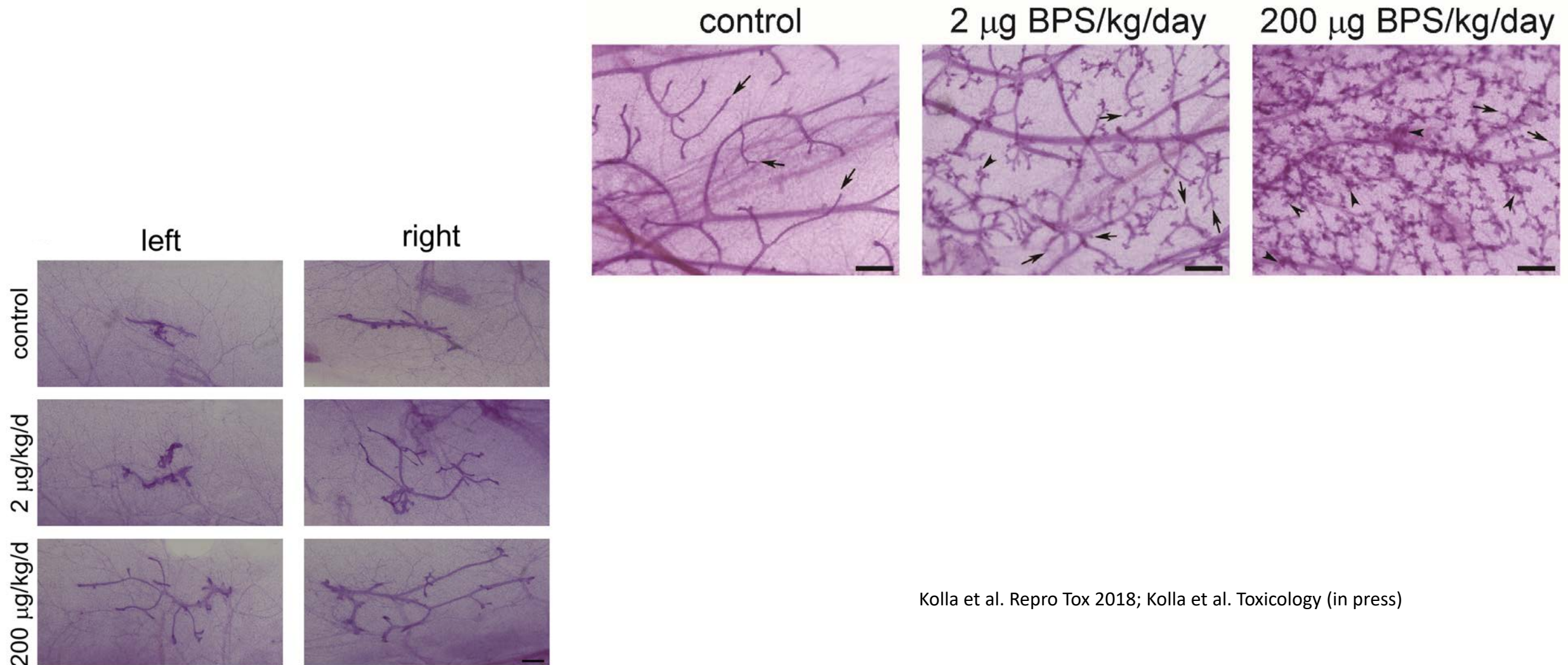
BPF

BPAF

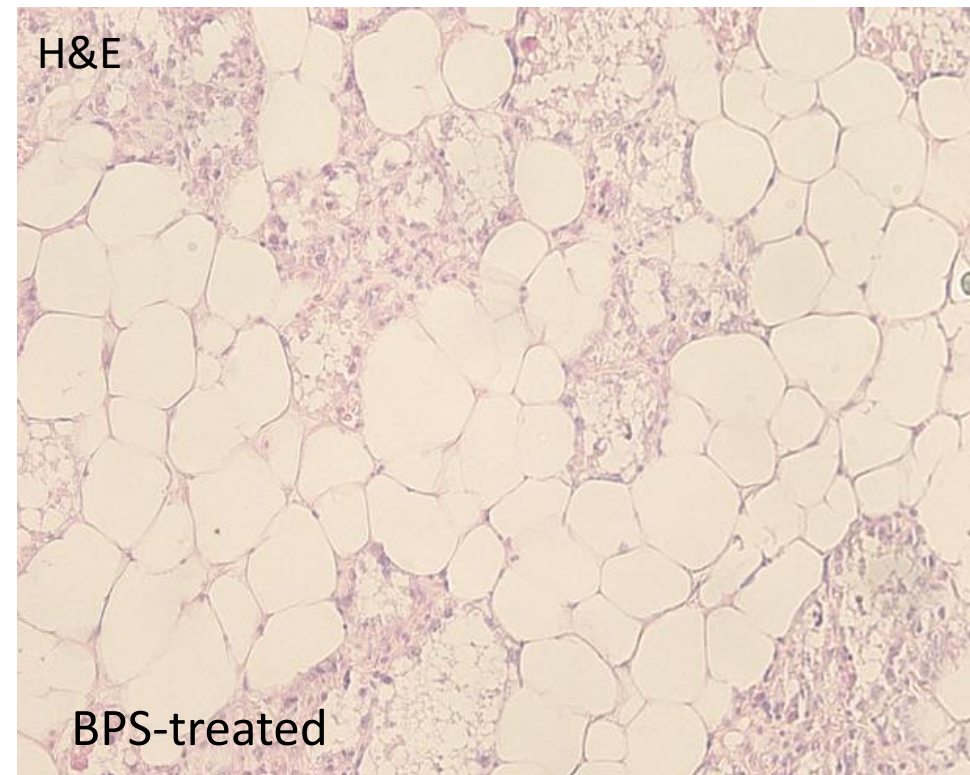
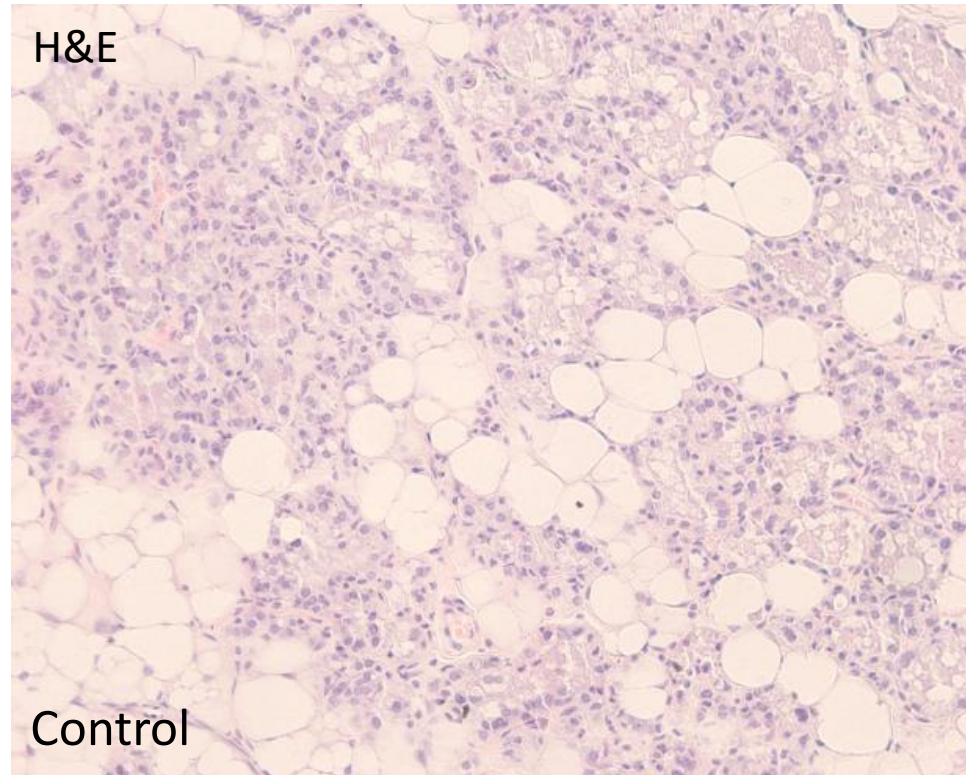
BPC

But BPA is just the tip of the iceberg...

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



BPS exposures alter mammary gland function in exposed mothers – and their daughters

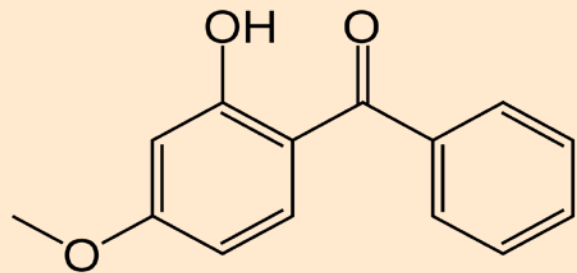


BPS exposures induce anxiety-like behaviors in offspring



BPS exposures alter maternal behaviors





oxybenzone



Food packaging

Consumer plastics

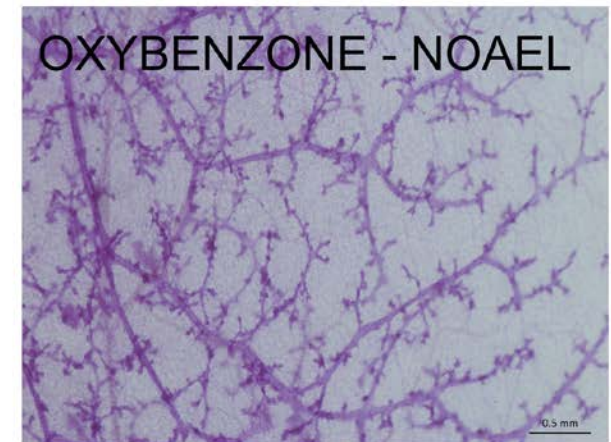
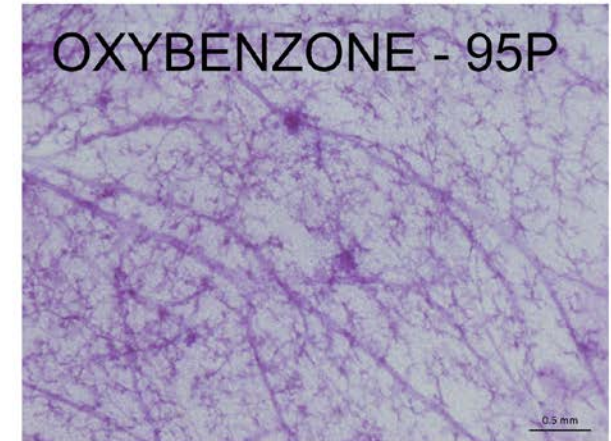
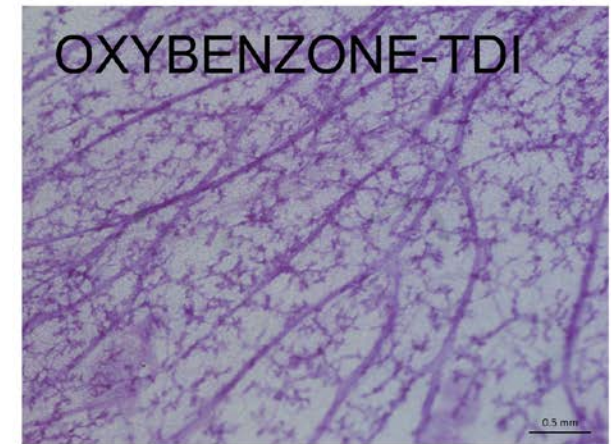
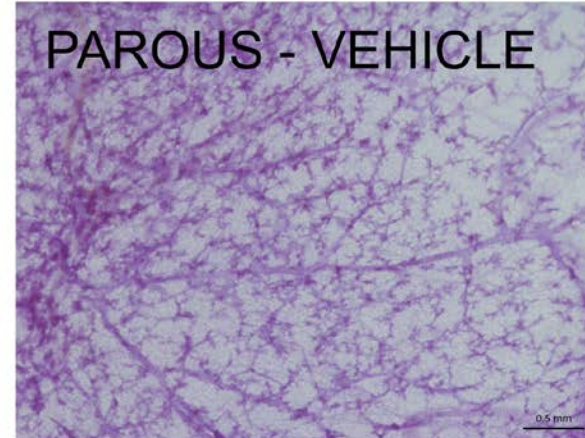
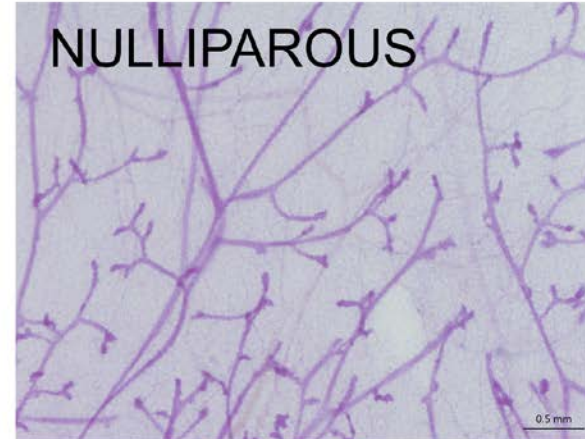


Sunscreens & cosmetics

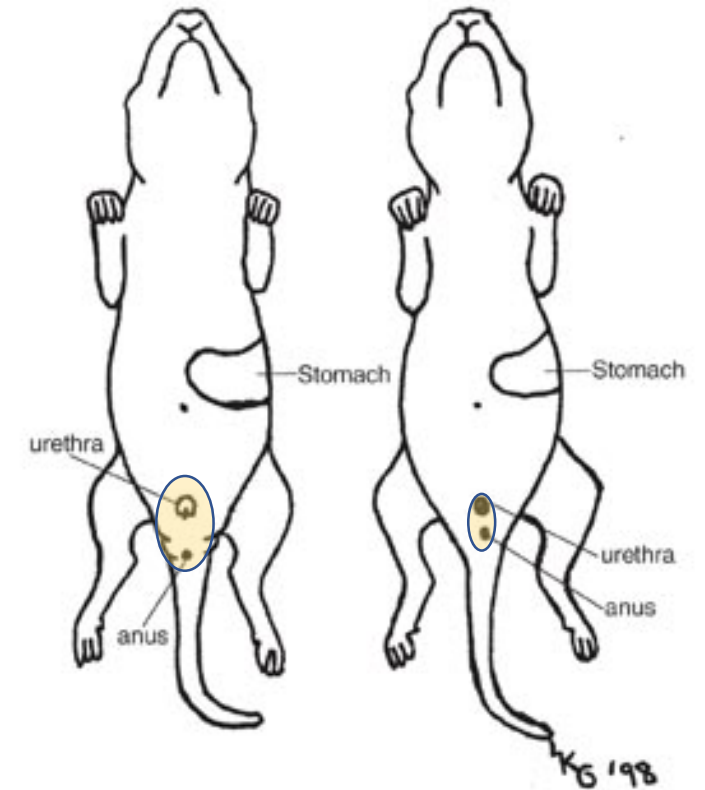
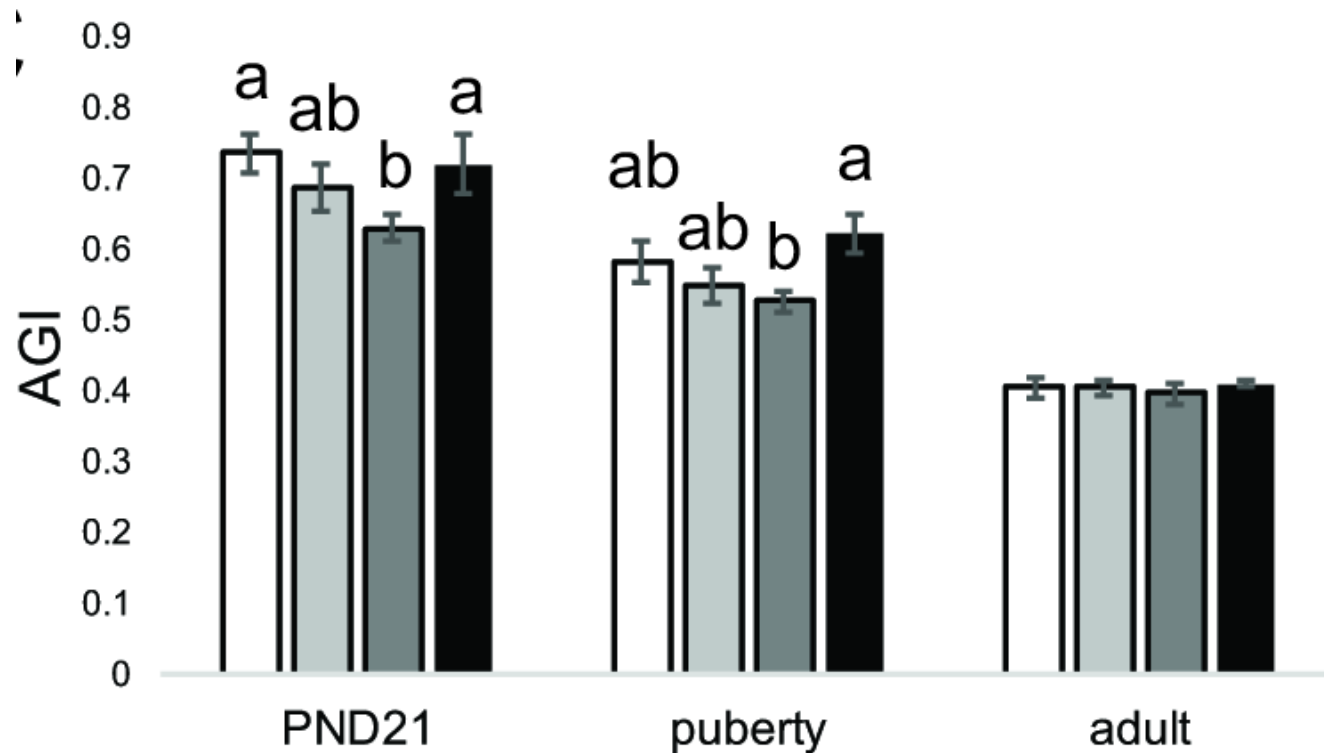
Clothing & fabrics



Exposure to oxybenzone during pregnancy permanently alters the mother's mammary gland



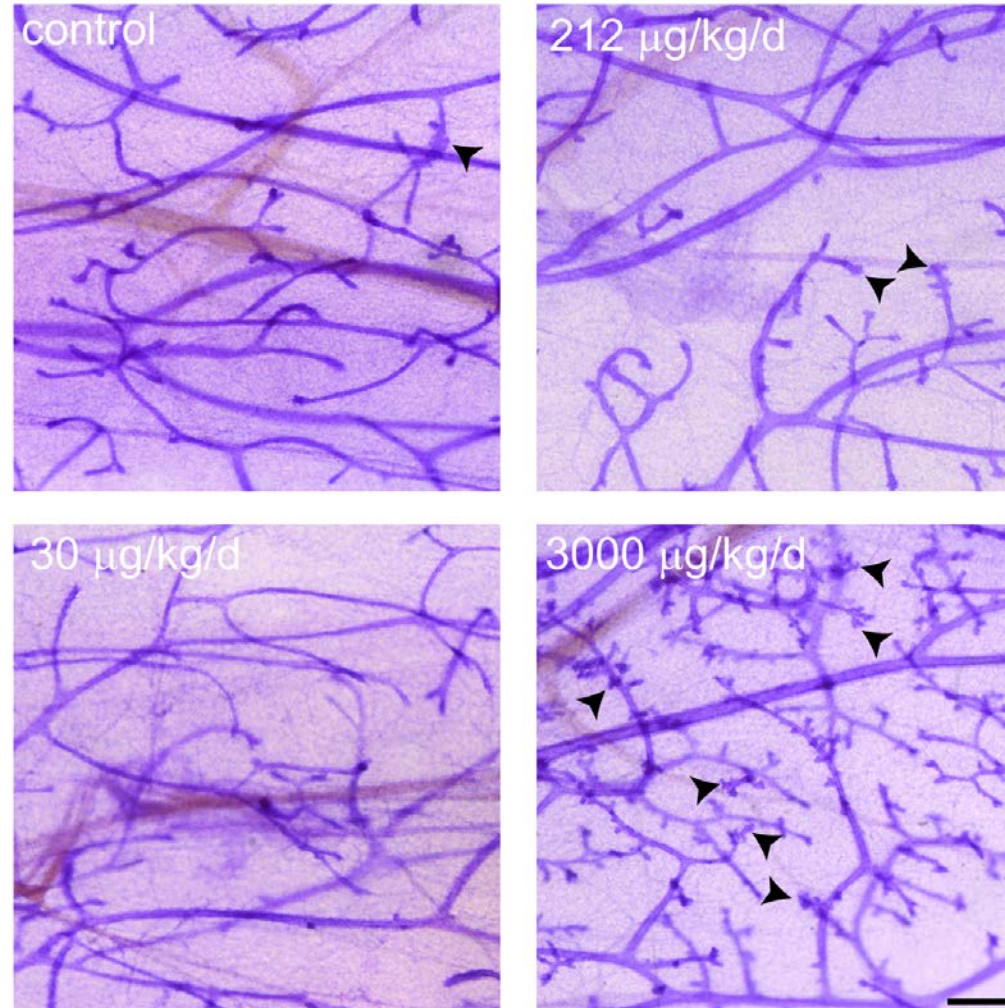
Oxybenzone exposure shortens anogenital distance in exposed male offspring



Male on the left, female on the right. Notice the distance is farther on the male between the anus and the urethra.

□ control ■ 30 µg/kg/d ■ 212 µg/kg/d ■ 3000 µg/kg/d

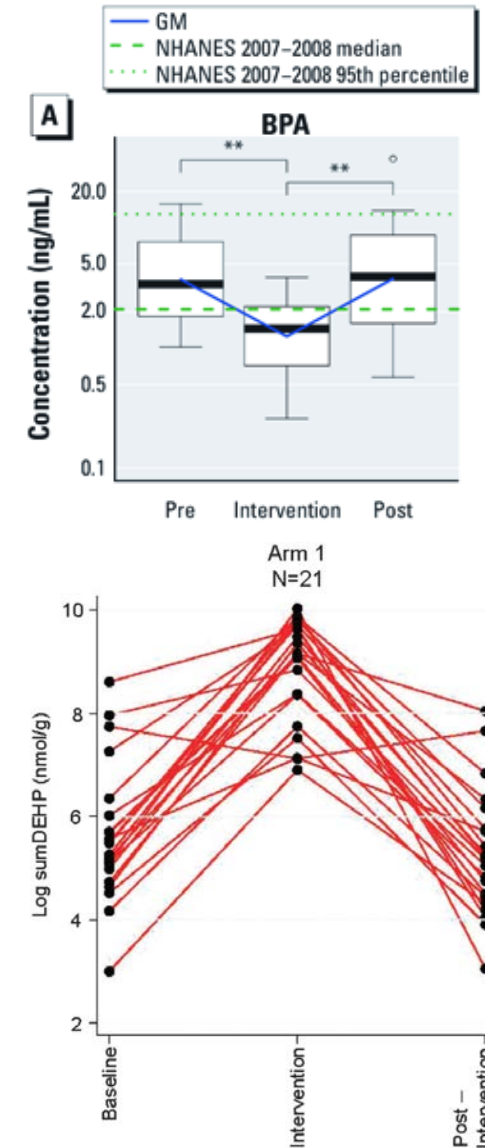
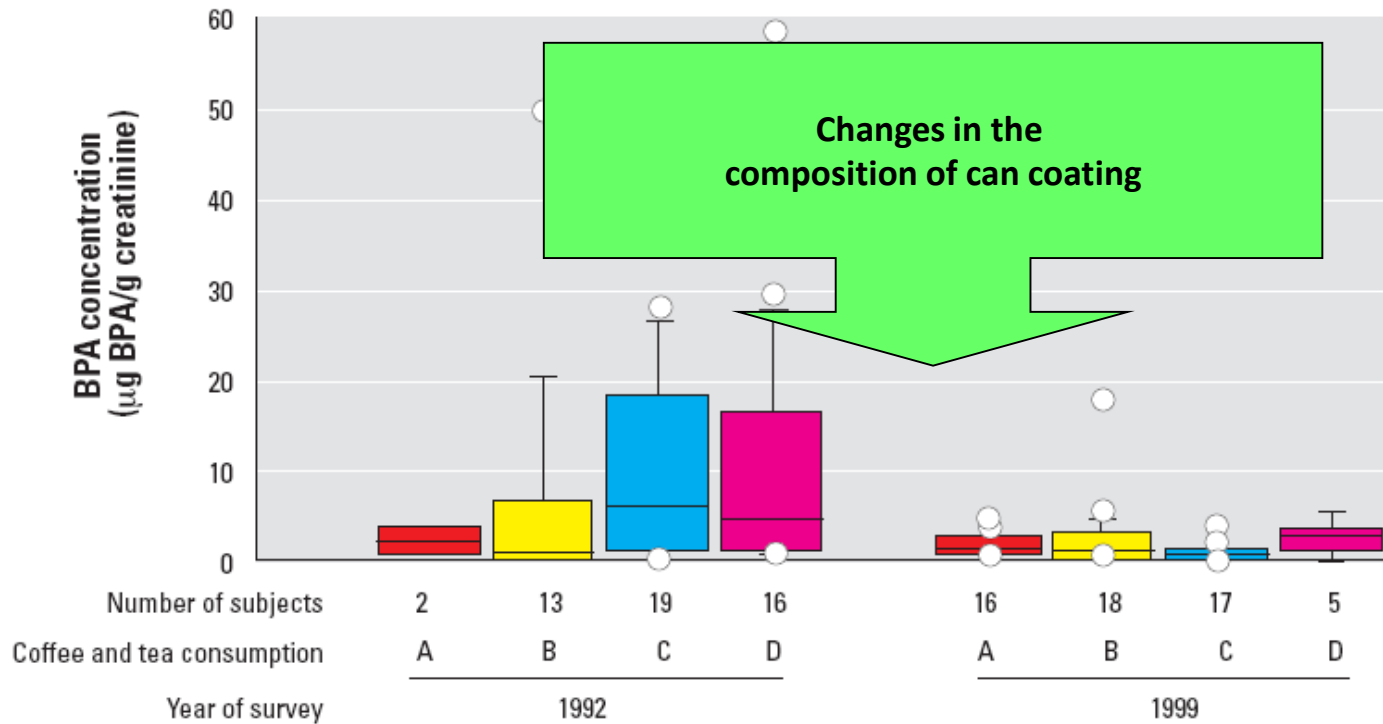
Oxybenzone exposure alters mammary gland development in exposed offspring (male and female)



There are numerous strong examples illustrating that food packaging chemicals can affect health

- Even though exposures are typically low, many food packaging chemicals are associated with adverse health outcomes in human populations
- Increasing numbers of human studies support a causal relationship between food packaging chemical exposures and diseases
- Animal studies have been very helpful in understanding the mechanisms by which hormonally active food packaging chemicals induce adverse health outcomes

There is (cautious) hope: changes in food packaging materials, or behaviors, can reduce exposures



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