



***PREVENTION STARTS HERE.***



Breast  
Cancer  
Prevention  
Partners

Exposing The Cause Is The Cure

# Breast Cancer and the Environment

## What we know; What we can do

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May 2, 2018

Credit to Sharmina Rasanayagam PhD

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All material can be found at [bccpp.org](http://bccpp.org)



Exposing The Cause Is The Cure

The National Cancer Institute predicted that in 2015 40,290 women and 440 men would die of breast cancer and 231,840 women and 2350 men would be diagnosed with invasive breast cancer in situ (that has not metastasized). As of early 2016, the NCI estimated that approximately 3,560,570 U.S. Women are living with a prior diagnosis of breast cancer.

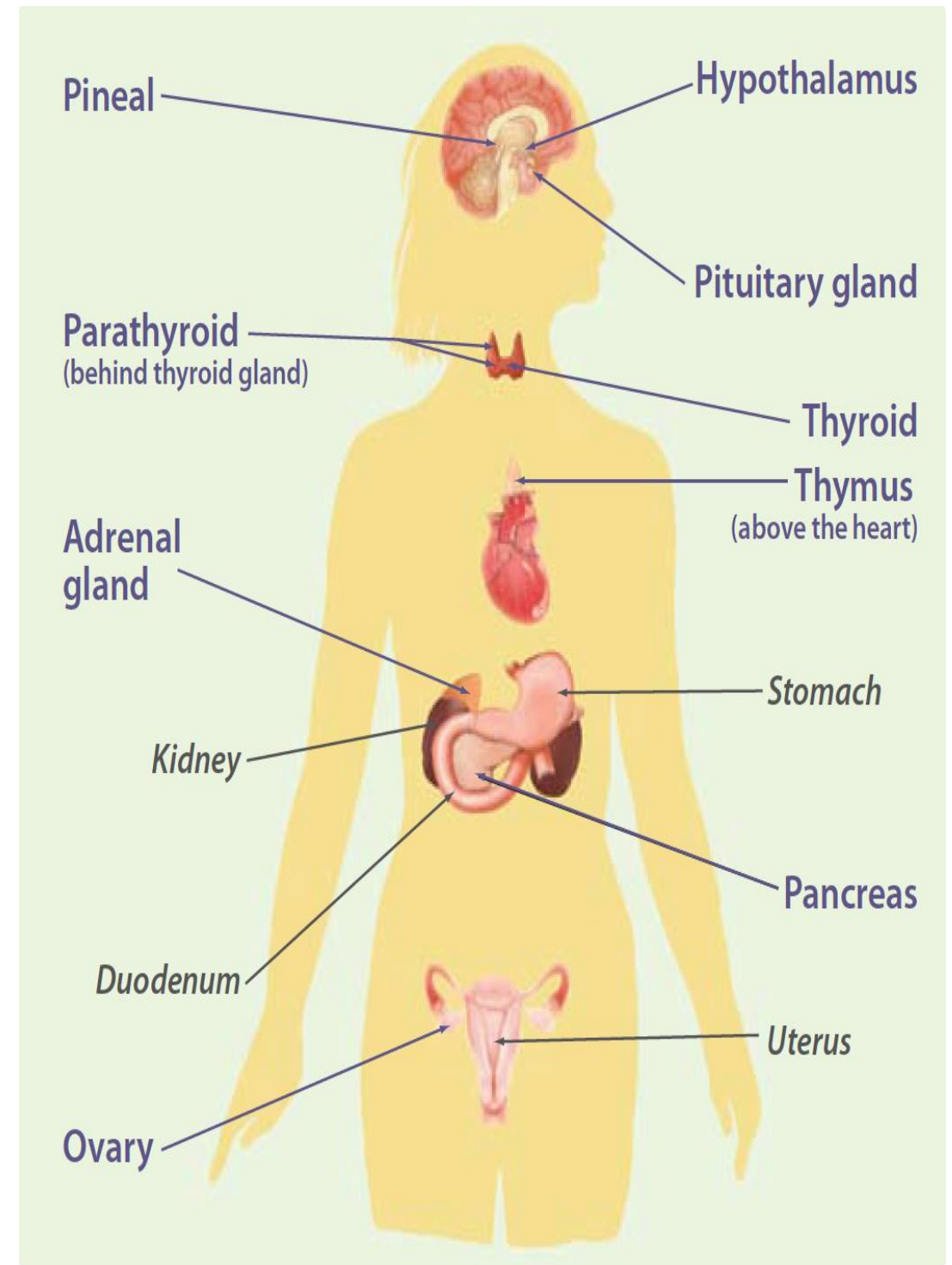
## *Secondary prevention is screening for cancer.*

Today I will give a brief overview of “**Primary prevention**” which means preventing the cancer from happening by removing the causes of breast (and other) cancers from our environment.

Our homes, hospitals, schools, workplaces, parks, air and water all have chemicals, carcinogens, EDCs and precursors of disease.

# Basic Breast Hormonal Physiology

The Endocrine System is comprised of glands that secrete hormones – chemical substances that travel in the blood stream to target tissues where they regulate bodily functions including the development of primary and secondary sexual structures including the breasts.



Basic structures of the breast develop early in prenatal period. By birth, the nipple is well-developed and the breast responds to maternal hormones. A few months later, breast tissues become responsive to progesterone.

In puberty breast cells grow and divide rapidly, in response to **specific patterns and doses of the natural estrogen**, estradiol.

Deep in the breast, the ducts grow into terminal end buds, much like the branches of a tree. The branching of the ductal system is impacted by progesterone. Throughout these processes, androgens (including testosterone, which is secreted by the adrenals in females), help to regulate and balance the development of breast tissue.

Breast Cancer is not a single disease.

ER stands for estrogen receptor

PR stands for progesterone receptor

HER2 is an oncogene

Other classifications :

- age (pre or post menopausal. Age 50 is the proxy for the shift between reproductive phases
- In situ
- Localized
- Regional
- Metastatic presentation
- Morphological characteristics
- Histological grade and cellular proliferation rate
- Gene expression profile



# Breast Cancer is not a single disease

Subtype	Characteristics	Proportion of diagnoses
Luminal A	ER+, low grade, often good prognosis (co-expresses PR) low Proliferation rate	50-60%
Luminal B	ER+, low grade, but faster growth than Luminal A (low or high proliferation rate or low PR expression)	15-20%
HER2+ overexpression	Grow quickly, but respond to targeted therapy Without ER or PR	15-20%
Triple-negative	ER-, PR- and HER2-; these are aggressive and more difficult to treat (more common in younger women – especially African American and to some degree Latinas. Doesn't respond to hormone based treatments or targeted therapies	15-20%

# Many Exposures are Linked to Breast Cancer



# Exposures Linked to Breast Cancer

## Exposures:

Carcinogens

Hormone Disruptors

Physical agents

## Description:

Linked specifically to cancer

Disrupt the body's hormones

For example, light-at-night,  
radiation

# Alaska and circumpolar areas at have increased concentration of PBTS a type of EDC

- Persistent bioaccumulative toxic substances do not degrade easily in the environment.
- PBTS are carried by winds for long distances, the molecules are carried to earth in precipitation and then evaporated again. When the temperature drops, they condense out of the atmosphere reaching higher concentrations in circumpolar regions because there is insufficient thermal energy to go through additional evaporation cycles.
- PBTS are released intentionally (pesticides) or unintentionally (by product of combustion).
- PBTS are lipophilic or they accumulate in fatty tissues and are slowly metabolized.
- Humans and animals are exposed to PBTS in the environment through air, water and food. They contaminate fish, marine mammals and birds of prey.

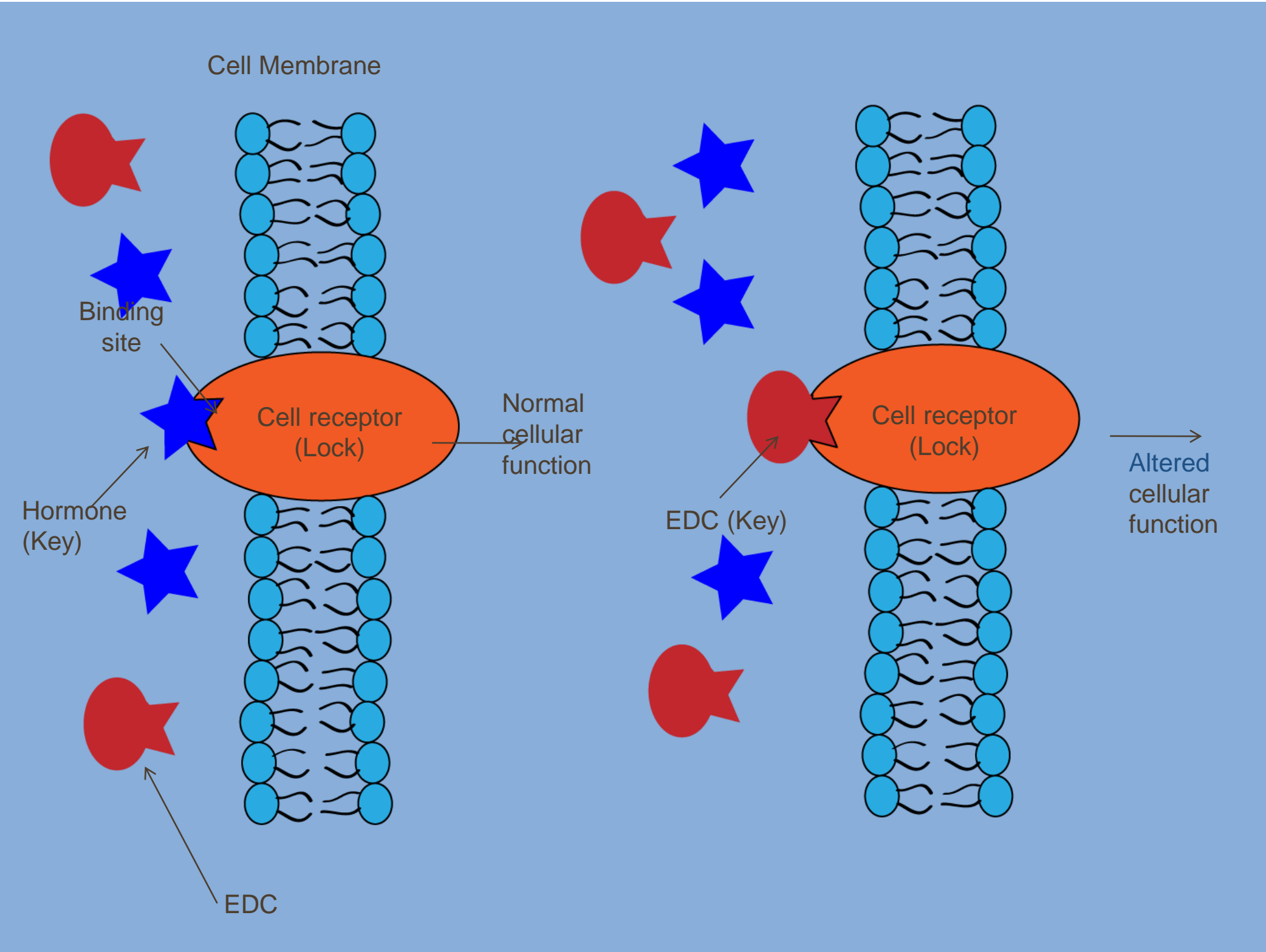
## EDCs Endocrine-disrupting compounds

- Have a different toxicological model (higher doses are more damaging than lower doses in non-toxicological model).
- EDCs act as natural hormones do – at very low doses physiologic responses may be greater than or at least different from exposures at higher doses.
- The timing of EDC exposure e.g. during fetal development, or just prior to puberty may have different effects.
- Scores of chemicals at multiple doses alone and in combination can have different effects including adaptive effects. At levels found in our environment, BPA (bisphenol A – a common plasticizer) significantly increased the increased effects of estradiol.
- EDCs can alter the regulation of genes involved in cell proliferation, through epigenetic processes.

Gray, J., Rasanayagarm, S., Engel, C. and Rizzo, J.: Environmental Health (2017) 16:94 State of the evidence 2017: an update on the connection between breast cancer and the environment. p. 4&5.

## Endocrine-disrupting compounds (EDCs) continued

- Low doses of EDC's, especially during critical stages of development can increase the risk of adverse health effects including cancers, neurodevelopmental and neurodegenerative diseases, metabolic disorders, asthma and immune disorders.
- Some EDCs also interact with molecules in the body that regulate cell growth and division, affect the metabolism (break-down) of hormones, and cause epigenetic changes.
- Extensive literature supports the hypothesis that early developmental exposures to EDCs including (but not limited to) diethylstilbestrol, bisphenol A, phthalates, atrazine and other pesticides and herbicides, and heavy metals including cadmium can increase risk for later development of breast cancer.





# Carcinogenicity classifications and sources of exposures for EDCs

IARC International Agency for Cancer Research NTP National Toxicology Program

1-Carcinogenic to humans, 2A-Probably carcinogenic to humans, 2B-Possibly carcinogenic to humans, 3 Not classifiable as to its carcinogenicity to humans.

K-Known to be a human carcinogen. RA-Reasonably anticipated to be a human carcinogen.

EDC	IARC	NTP	Source of exposure
Bisphenol A BPA			Polycarbonate plastic, epoxy resins linked food cans, dental sealants thermal receipts
Phthalates	2B	RA	Fragrance ingredients in personal care and cleaning products, plastics. Also pharmaceuticals, building materials, insecticides and food packaging/food processing
Diethyl phthalate (DEP)	3		
Parabens			Antimicrobial preservatives in food, personal care products, soaps and detergents and pharmaceuticals
Alkyphenols Triclosan & Triclopcarban			Detergents and cleaning products, antioxidants in plastic and rubber products Antimicrobials in liquid hand soap, other personal care products and household items



Continued **Carcinogenicity classifications and sources of exposures for EDCs**

<b>EDC</b>	<b>IARC</b>	<b>NTP</b>	<b>Source of exposure</b>
Hormonally active ingredients found In sunscreens			UV filters
Perfluorooctanoic Acid (PFOA) & Perfluorooctanoic Sulfate PFOS	2B		Stain resistant coatings, non-stick coatings, commercial products including fire fighting foams
PolyAromatic Hydrocarbons benzaantracene benzoapiyrene	2B 1	RA RA RA	By products of combustion resulting from fossil fuel production, diesel exhaust, grilled meats, cigarettes
Triazine herbicides			Weed control for corn and sorghum crops
Other pesticides and herbicides Chlordane Malathion 24-D Banned:Heptachlor Dieldrin & Aldrin 2,4,5,trichlorophenoxpropionic acid	2B 2A 2B 2B 2A		Home termites, general crop pesticide Residential, recreational crop pesticide Broadleaf weed herbicide Insecticide Insecticide for corn & cotton Woody plant and broadleaf weed herbicide

## Continued Carcinogenicity classifications and sources of exposures for EDCs

Persistent organochlorines			
PCBs	1	RA	Electrical insulation, fluid coolants, plasticizer in paints dyes and inks
Dioxins:2,3,7,8,tetra chlorodibenzo-para-dioxin	1		
Polybrominated Dienyl Ether (PBDEs)			Flame retardants, previously used in furniture and electronics, most have been banned or voluntarily phased out
Aromatic amines			
o -toluidine	1	K	Hair dyes
4-aminobiphenyl	1	K	AZO dyes in textiles
p-phenylenediamine			Hair dyes
2-amino-phenylimidazo			Cooked meats
heterocyclic aromatic amines			Hair dyes
Metals			
Cobalt	PO	RA	Naturally occurring elements; contaminants in naturally derived colorants, clays and other metals found in cosmetics, toys, and other products
Nickel	PO		
Lead	2B	RA	

## Continued Carcinogenicity classifications and sources of exposures for EDCs

Methylmercury	2B	K	Naturally occurring elements; contaminants in naturally derived colorants, clays and other metals found in cosmetics, toys, and other products
Cadmium	1		
Iron	1		

Gray, J., Rasanayagam, S., Engel, C., Rizzo, J

State of the Evidence 2017: an update on the connection between breast cancer and the environment.

Environmental Health (2017) 16:94

# Exposures Linked to Breast Cancer

## **Encountered every day**

At home

At work

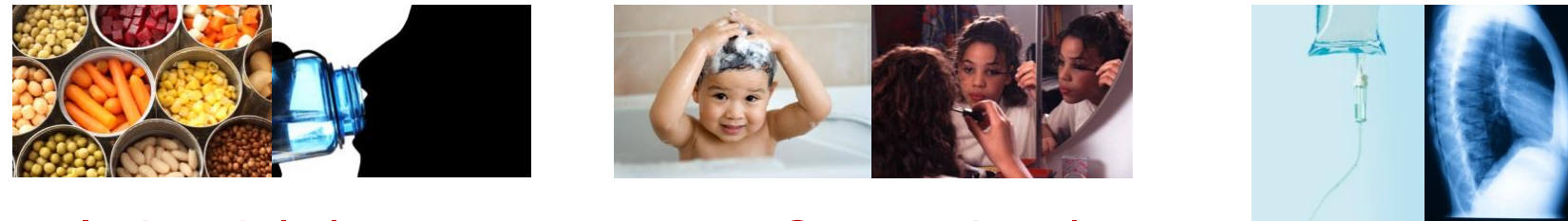
Indoors and out

# Failure of Federal Regulation

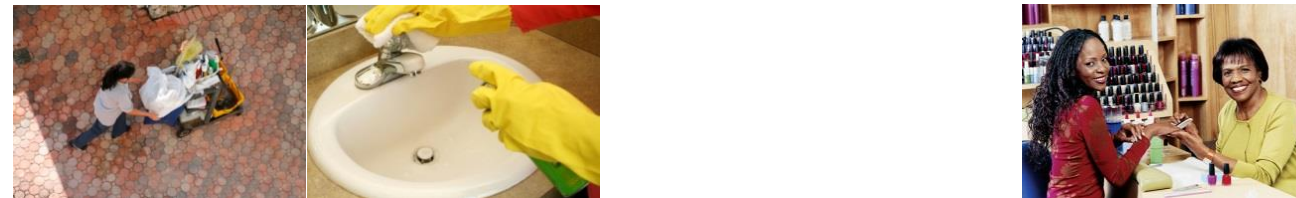
**EPA** Industrial Chemicals Pesticides Air Water



**FDA** Food contact substances Personal care products Medical devices



**OSHA** Industrial cleaners Occupational exposures



**CPSC (Consumer Product Safety Commission)**

Consumer products Household cleaners





# Failure of EPA and TSCA

By the Numbers

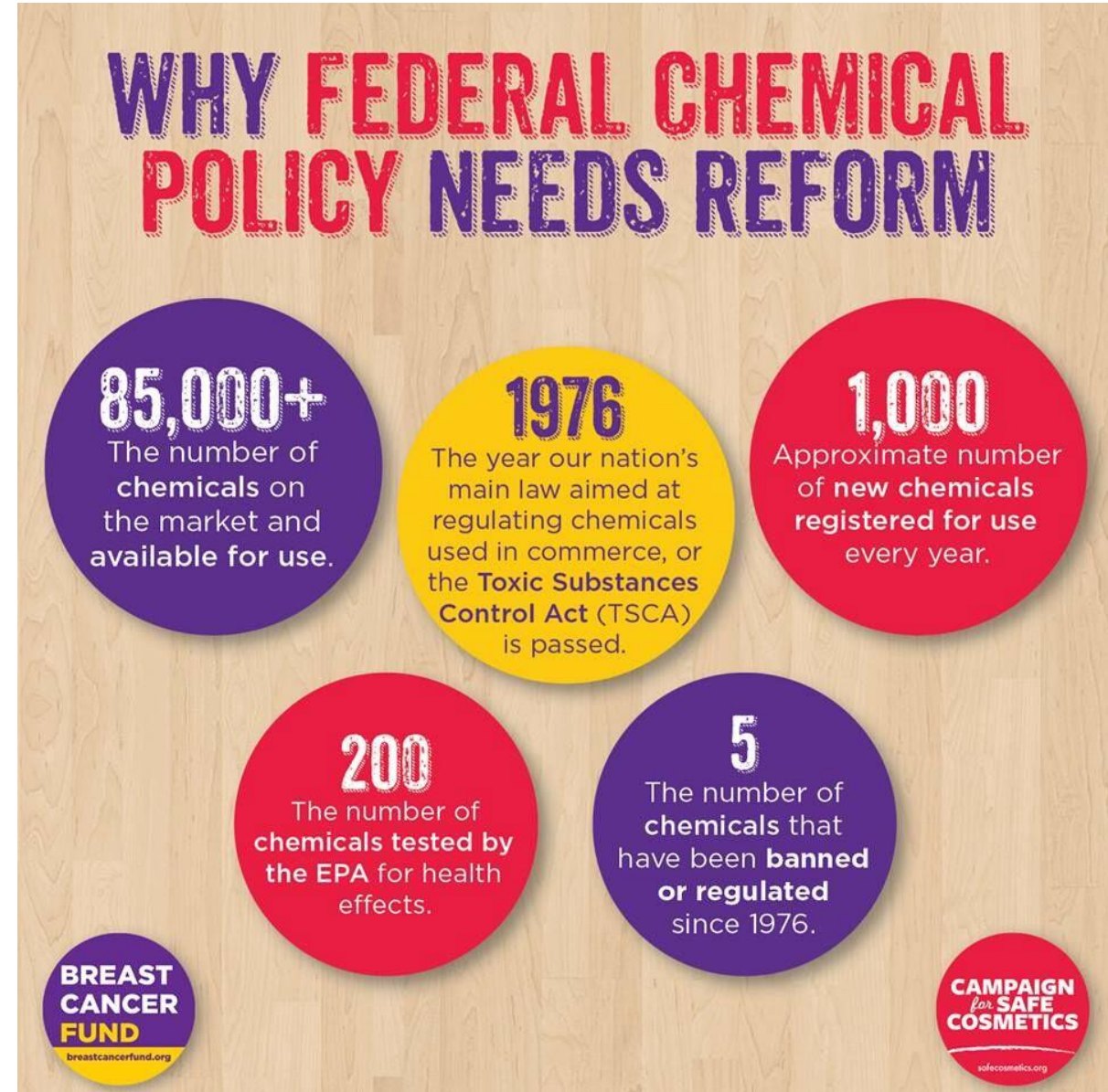
85,000 chemicals

62,000 grandfathered

200 chemicals tested

39 years without updating

5 chemicals regulated



# Exposures throughout the day

**What might we encounter in a typical day and what are the tips to avoid them?**



# Exposure Effects Vary

## Life stage

Prenatal

Childhood

Pregnancy

## Individuals

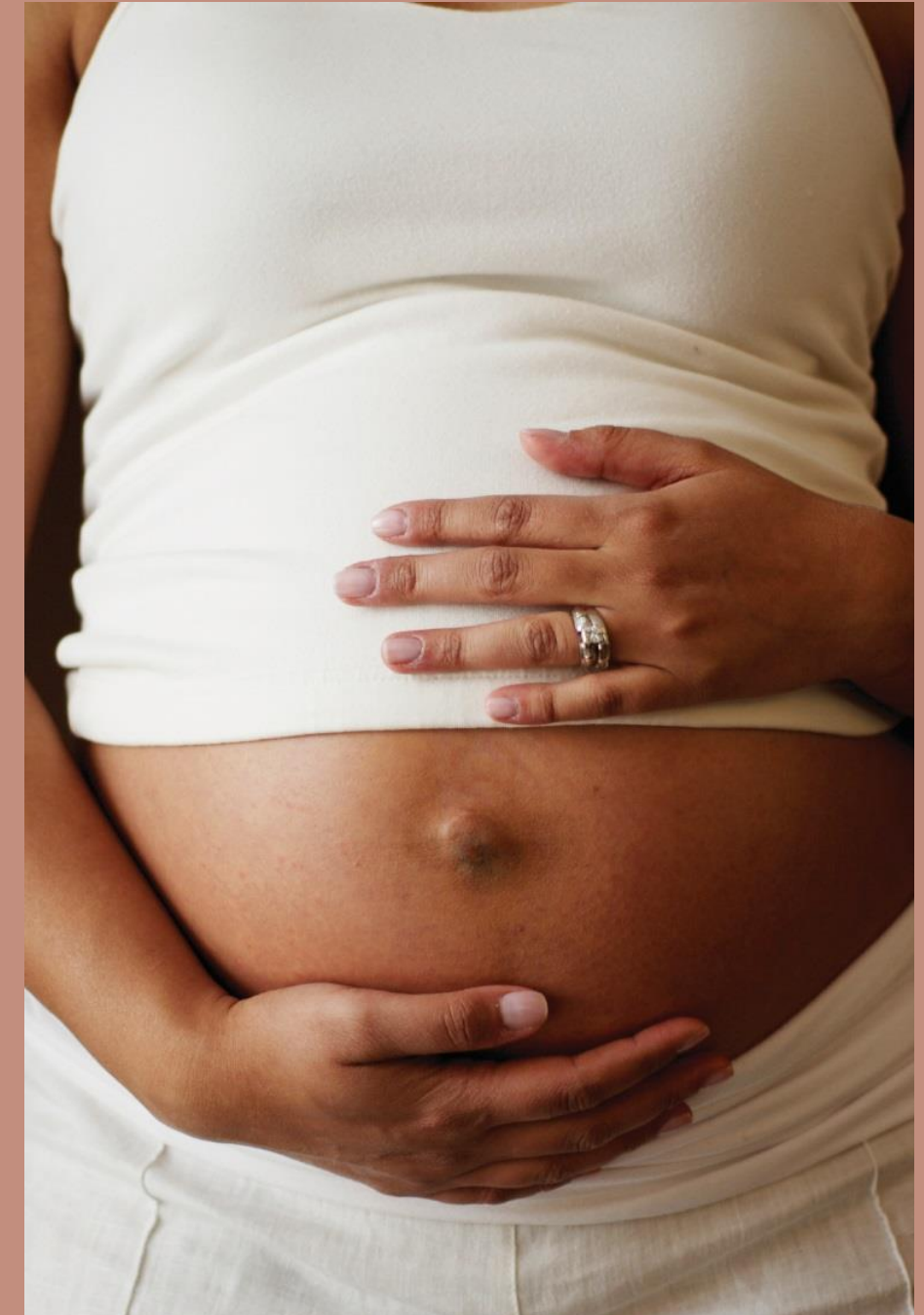
Genes

## Societal factors

Built environment

Social stress

## Mixtures and Low Doses





# Wakeup time



## Morning Routine

Detox your morning routine by choosing products **free** of the worst chemicals.



# Failure of the FDA

**No Pre-Market Testing  
for Safety**

**No Recall Authority**

**No Adverse Event  
Reporting**

**\$71 Billion Industry –  
*Self-Regulated***



**Since 2014, the Campaign for Safe Cosmetics**, a project of BCPP, has been asking cosmetic companies to make a public commitment to eliminate carcinogens from its personal care products and cosmetics

Nail polish

Lotions

Hair color

Anti-aging products

Hair straighteners

Eye Shadow, Eye Pencils, Eye liners

Blushes and Powders

Fragrances-”secret chemicals”



# Chemicals in Cosmetics

## Toxic Chemicals

Formaldehyde

Dibutyl Phthalate

Coal Tar

Health Impacts:

Cancer

Birth Defects

Reproductive Problems

Learning Disabilities



# School time



## **Schools:**

Schools are a great space for local advocacy. Parents can help ensure play spaces free of pesticides, that the water is safe and soaps in the bathrooms are free of the worst chemicals.

# Lunch time



## **Food:**

Fresh, organic foods are great for the environment, and they also help reduce exposures to chemicals of concern. Look out for cans

Don't microwave in plastic



# Work time



## **Workplaces:**

Women in many jobs can face exposures of concern, and some jobs come with an increased risk of breast cancer.

# After school

## **Afternoon routines:**

Washing hands can help reduce exposures to chemicals that pile up in dust. Just be sure to use a soap free of triclosan.

Take your shoes off at the door.





# Outdoor time



## **Sun Protection:**

What does sun protection have to do with breast cancer?

Some UV filters stimulate estrogen. Choose sunscreens with non-nano titanium dioxide or protect yourself with a hat or clothing.

# Cooking time



## Food prep:

Work is afoot to create safer food cans, but for the time being limit consumption of canned foods. Be careful with nonstick cookware as well...some nonstick pans contain PFAS chemicals.



# Clean-up time



## **Cleaning products:**

When it's time to clean-up, choose products that fully list ingredients.

# Screen time



## **Electronics disposal:**

Our electronics are made with all kinds of chemicals. Be sure to dispose of batteries and old electronics responsibly.

# Bed time



## **Flame retardants:**

For bedtime, choose a mattress free of flame retardants. Natural flame retardant barriers help create a safe sleep environment.



# Night time



## **Light:**

If outside light filters into your bedroom at nighttime, consider light-blocking curtains. Try to make your sleeping space free of blue electronic lights as well.

# Recent literature review identified the Social Determinants of Health as Risk Factors

- Four themes emerged from a review conducted for the CA Breast Cancer Prevention Plan from a review of 19 articles
  1. Neighborhood economic and educational factors and segregation
  2. Local exposures
  3. Urbanization
  4. Trauma and hunger

# Social Determinants of Health

Race, ethnicity, socioeconomic status and other social factors also shape breast cancer risk.

These interactions are complex, because access to health care, exposures to environmental chemicals, access to healthy foods and safe spaces for physical activity, occupation, and community stress and security are affected by the built environment, social networks, geographic location, poverty and race. As a result, the actual causes of these disparities likely emerge from the complex social dimensions of class and race in the United States.

Socioeconomic status, race and ethnicity probably serve as markers for other activities or circumstances that influence the level of exposures to potentially toxic chemicals.



## Two soon to be published articles:

### Work and Female Breast Cancer: The State of the Evidence, 2002–2017

Connie L. Engel<sup>1</sup>, M. Sharima Rasanayagam<sup>1</sup>, Janet M. Gray<sup>1,2</sup>, and Jeanne Rizzo<sup>1</sup>  
NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy 2018,  
Vol. 28(1) 55–78

### Work and Breast Cancer: Recommendations to Address Research Needs

Connie L. Engel<sup>1</sup>, M. Sharima Rasanayagam<sup>1</sup>, Janet M. Gray<sup>1,2</sup>, and Jeanne Rizzo<sup>1</sup>  
NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy 2018,  
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# What can we do?

**Get informed**

**Shop smart**

**Advocate**

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# What can we do?

**As Individuals**

**At home**

**At work**

**Within our communities**

**State and nationally**

**HB 27 HB 53** The Toxic Free Children Act (HB 53 / HB 27) is a state bill that would ban ten toxic flame retardants in children's products and furniture.

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**[bcpp.org](https://bcpp.org)**

Breast Cancer Prevention Partners (BCPP) works to prevent breast cancer by eliminating our exposure to toxic chemicals and radiation linked to the disease.