

*Breast and other Hormonal Cancers and the Environment:  
the case for environmental oncology*

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**Reasons why “environment”  
is a cause of cancer**

**Fewer than 1 in 10 cases of breast  
cancer arises in women born with  
genetic defects**

National Cancer Institute





## Reasons why “environment” is a cause of cancer

- ! **Cancer risk of adopted children mirrors that of their adopted (NOT their biologic) parents**
- ! **Fewer than half of identical twins get the same cancer**
- ! **Workers have higher rates**
- ! **Patterns remain explained**

3

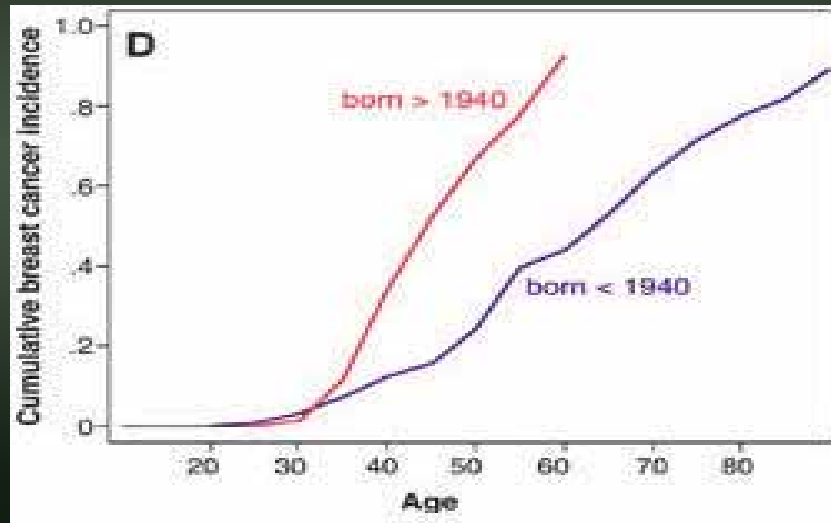


## Reasons why “environment” is a cause of cancer

- ! **Migrants’ cancer risk changes to that of their new country**
- ! **The majority of cases have no known risk factors**
- ! **Women with higher residues of toxins in their blood have more aggressive disease**

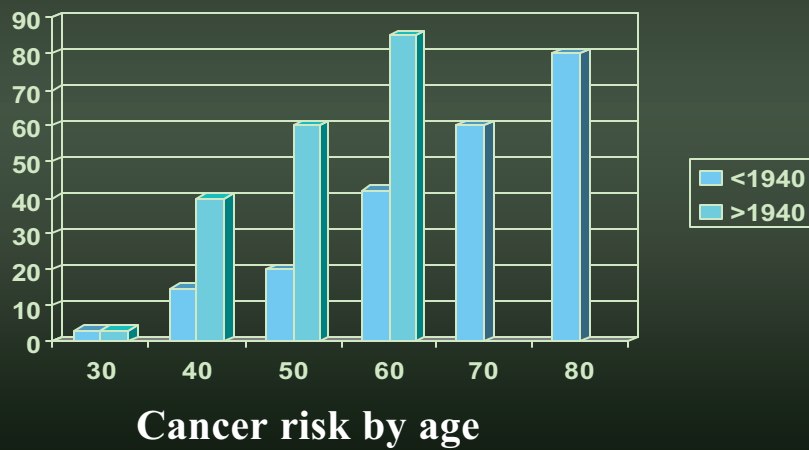
4

### Unexplained patterns of breast cancer in women with BRCA 1 (M.C. King, 2003)

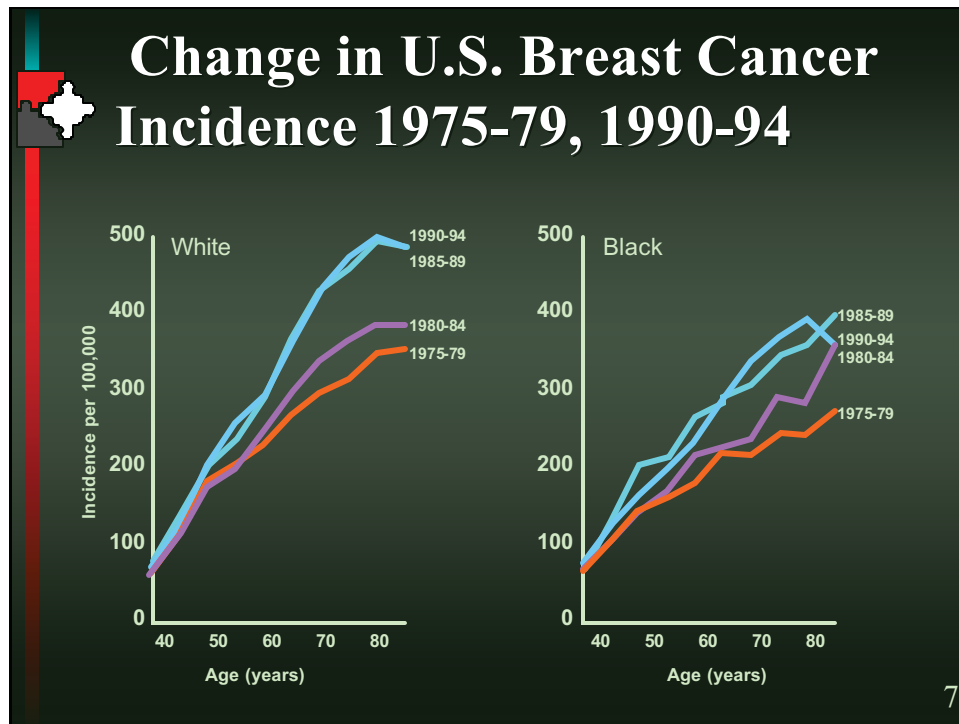


5

### Cumulative Risk of Breast Cancer in BRCA1 carriers born before or after 1940 (M. King, 2003)

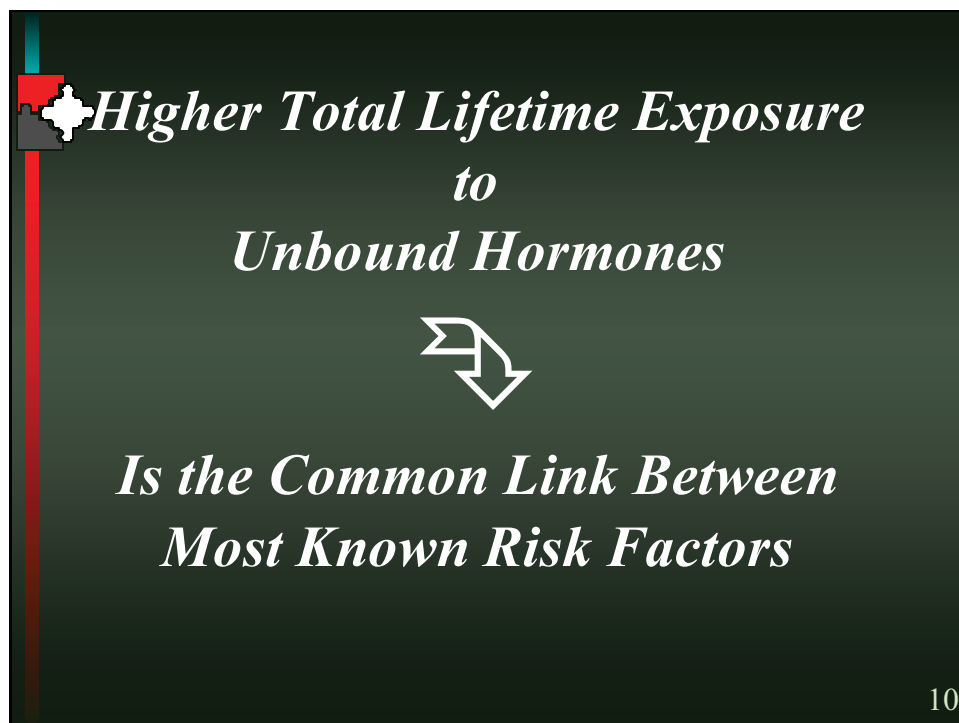
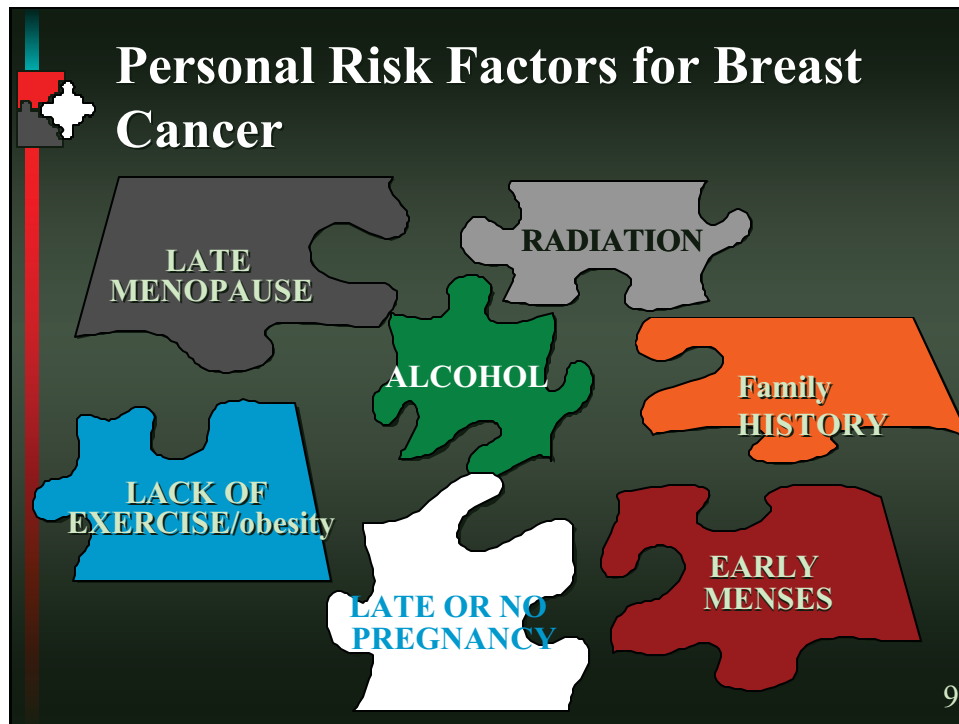


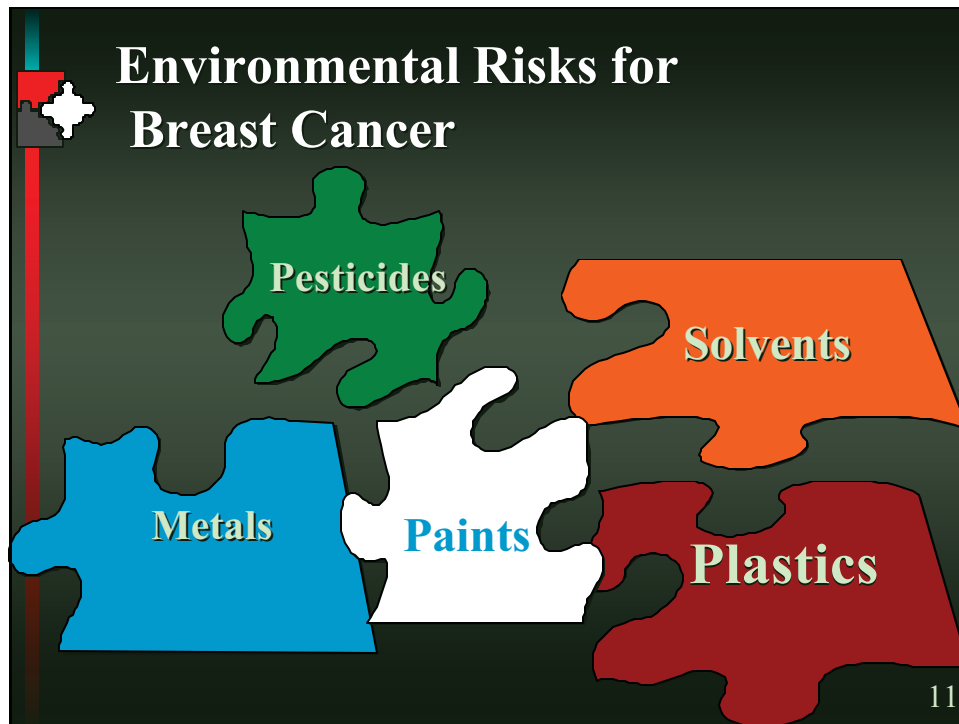
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## Risk Factors for Breast Cancer

Risk factors are characteristics or experiences shared by those with the disease compared to those without it







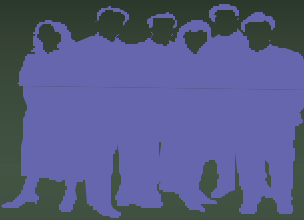
## Figuring Out the Causes of Cancer

- Means looking at all evidence
- Understanding limits of study designs
  - Toxicology provides controlled experiments
  - Human studies are usually 'natural' experiments

A cartoon detective wearing a black trench coat, a white shirt, a black hat, and a yellow scarf. He is holding a magnifying glass over a large red footprint. The footprint is on a dark background.

12

## Available Evidence for Understanding Causes of Cancer

**Wildlife & Case Studies**      **Toxicology**      **Human Studies**

Human studies cannot always be conducted. Models and measurements of exposure along with toxicology & case studies fill knowledge gaps.

13

## Criteria for identifying causes of cancer

1. Strength of association
2. Consistency
3. Specificity
4. Temporality
5. Biological gradient
6. Biological plausibility
7. Coherence
8. Experiment
9. Analogy

14

## Toxicologic Evidence on Causes of Cancer



15

## Animal Carcinogens Cause Cancer in humans

- ! Every compound known to cause cancer in humans
- ! Also causes it in animals, when adequately studied.
- ! Therefore any animal carcinogen should be treated as a human carcinogen\*
- ! \*IBM Think Magazine, 1983

16



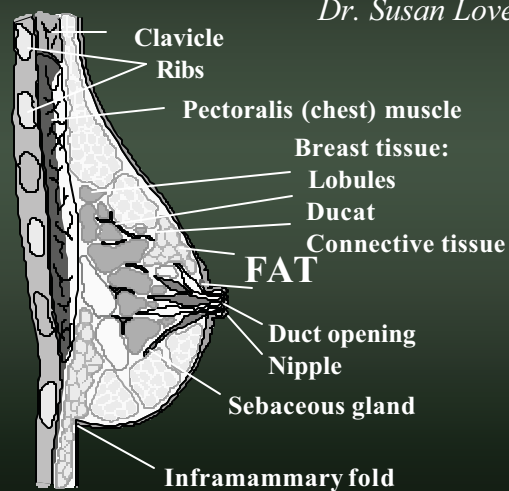
## Causes of Breast Cancer can be hormonal or genetic

- Hormonal causes can distort hormones and influence breast cell growth
- Genetic causes can damage DNA
  - Diminish repair
  - Promote deranged growth

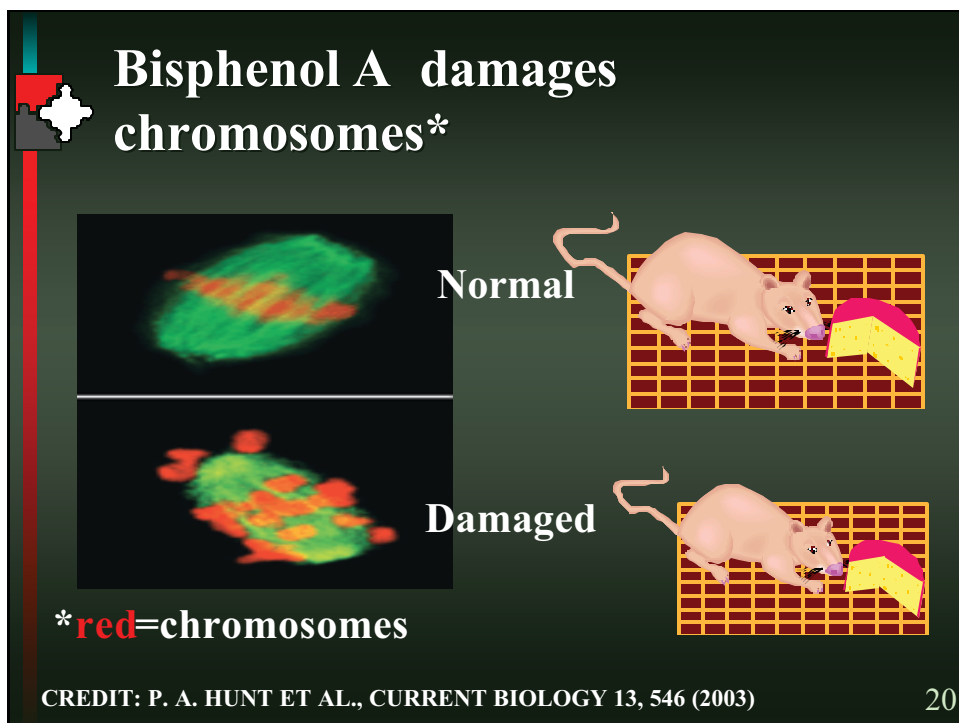
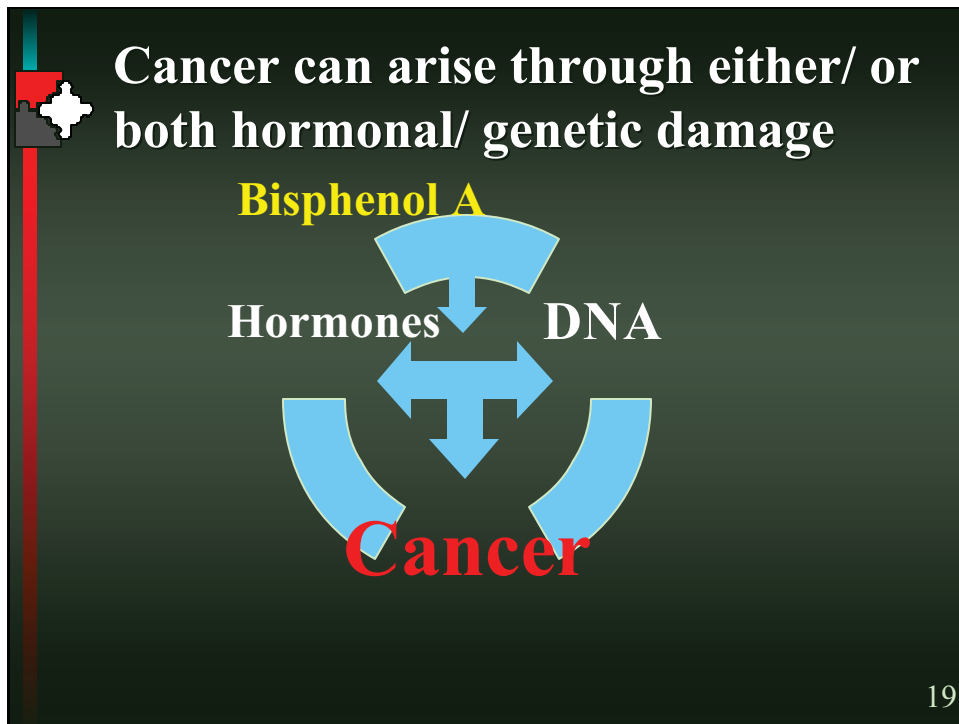
17

## Breast cancer biology

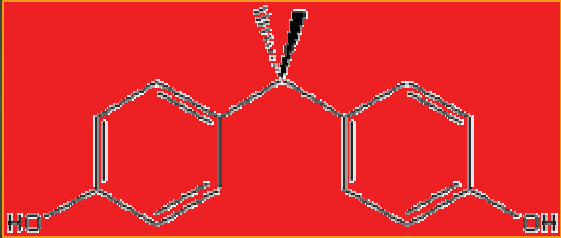
*Dr. Susan Love's Breast Book*



18



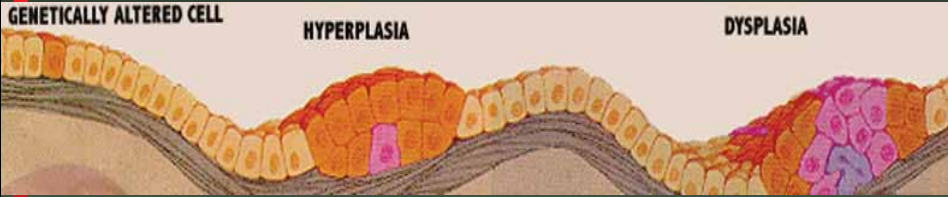
## Bisphenol A distorts Hormones



**Bisphenol A Is Released from Used Polycarbonate Animal Cages into Water at Room Temperature**  
 Howdeshell et al., Environmental Health Perspectives Volume 111,  
 Number 9, July 2003


21

## Stages of tumor development



**do not depend on whether or not tumors first arose from hormones or from genetic damage**

22




## Some cancer-causing exposures in animal toxicology studies

- | Benzene\*\*
- | Formaldehyde
- | Isopropyl alcohol/acetaldehyde
- | Freon
- | Epichlorohydrin/BPA
- | Toluene/xylene/acetone (benzene contaminant)

| \*\*mammary carcinogen

23

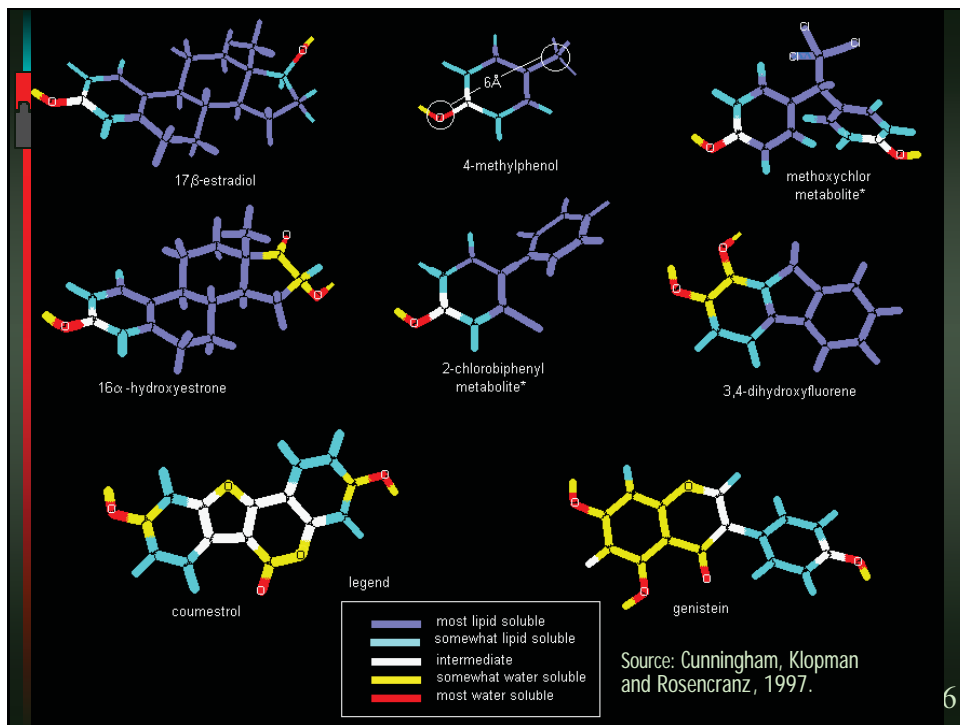
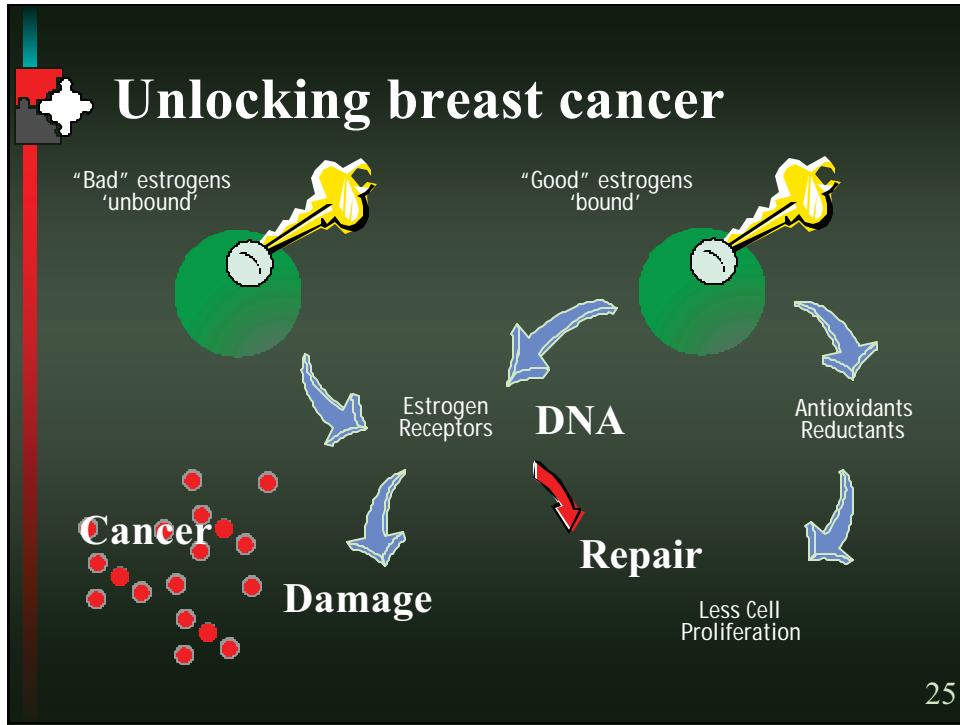


## Some hormone distorting exposures from animal toxicology studies


- | Bisphenol A (1936)
- | Benzene\*\*
- | Isopropyl ?alcohol/acetaldehyde
- | Freon/nitromethane stabilizer

| Mixed organic solvents?

24



## Human Evidence



27

## Epidemiologic Studies: Breast Cancer Risks from workplace studies

<b>Cantor, 1995</b> 24 U.S. states death records 1984-89	<b>29,397 cases</b> <b>white women</b> <b>102,955</b> <b>controls</b>	<b>1.19 (1.1-1.3)</b> <b>1.19(.9-1.6)</b> <b>1.10 (1.0-1.2)</b>	<b>Formaldehyde</b> <b>Styrene</b> <b>Org. solvents</b>
<b>Petralia,</b> <b>1998</b>	<b>All Br CA cases</b> <b>in Shanghai</b> <b>1980-84</b>	<b>14.7(5.9-30.3)</b> <b>1.3 (1.1-1.8)</b>	<b>Doctors</b> <b>Benzene</b> <b>workers</b>
<b>Hansen, 1999</b> <b>Danish</b> <b>workers</b>	<b>8,767 cases &amp;</b> <b>controls</b>	<b>1.84 (1.15-2.95)</b> <b>1.59 (1.13-2.24)</b> <b>1.3 (1.1-1.4)</b>	<b>Chem.workers 15+</b> <b>years</b> <b>No lag</b> <b>All solvent workers*</b>

\*aromatic solvents, BTX

28

**Epidemiologic Studies: Breast Cancer Risks from Workplace Studies**

Shannon, 1988	1,044 women 826 men Canadians	SMR 204 Coiling/wire	methylene chloride and other organic solvents
Spirtas, 1991	14,457 Utahns 9400 men 3138 women retrospective	Lifetable/TG 309 (113-675) 312 (125-643) 310(113-675)	Freon Isopropyl alcohol Solder flux

\* xylene, toluene <sup>29</sup>

**Acute effects of toxins imply chronic effects**

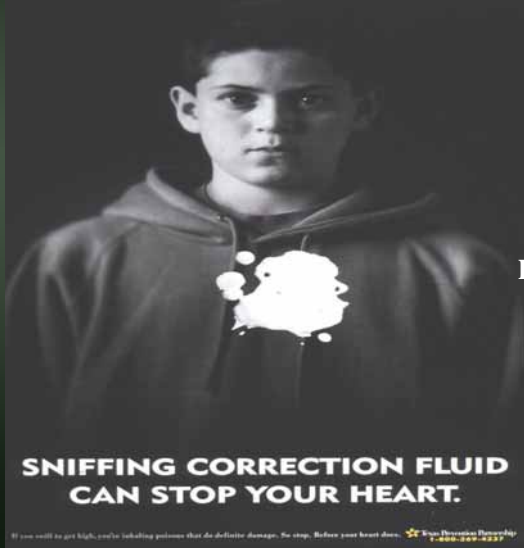
toluene  
fluorocarbons

**SNIFFING MARKERS DESTROYS YOUR BRAIN.**

Sniffing ink, glue, spray paint or markers can cause brain damage, lung damage, even death. Team Research Partnership

30

## Acute effects of toxins imply chronic effects



toluene  
methanol


SNIFFING CORRECTION FLUID  
CAN STOP YOUR HEART.

If you need to get high, you're inhaling poisons that do definite damage. So stop. Before your heart does. EPA/Environmental Protection Agency

31

## Jobs with increased risk of breast cancer

- ! Solvent workers
- ! Chemists
- ! Nurses/Dentists and Physicians
- ! Painters
- ! Hair Dressers



32



## Household exposures to breast carcinogens in the urban environment

- Benzo-a-pyrene is higher in house dust than soil
- Smaller particles are more toxic and tracked in preferentially
- Smaller particles have more surface area relative to their weight



**John Roberts, Master Home Environmentalist**

## Studying Humans Is Difficult

- People seldom know what they have been exposed to, especially early in life
- Both good and bad xenoestrogens exist
- Studying current levels or recent residues in cancer patients can be misleading — disease development affects storage of toxic compounds

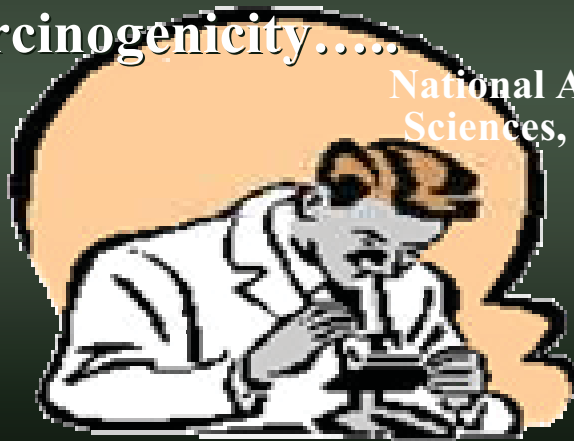
## Problems of Power in Epi Studies

- ! Easier to find big risks in large populations than in smaller ones
- ! Harder to find differences between groups for common diseases like breast cancer
- ! The absence of evidence is not evidence of an absence of an effect
- ! Statistical significance is not the same as public health importance

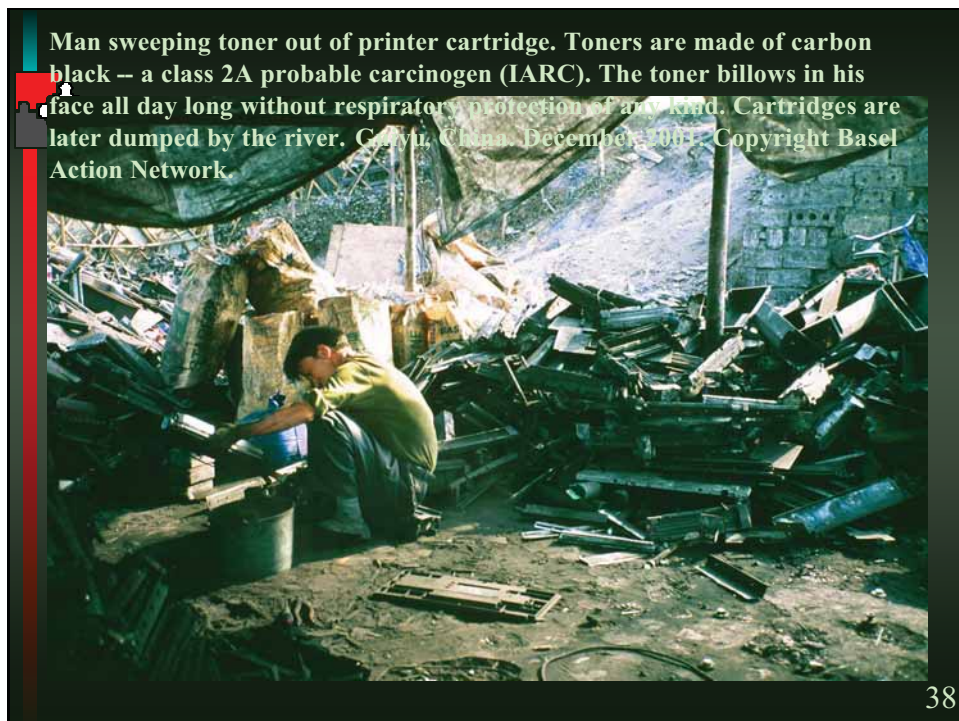
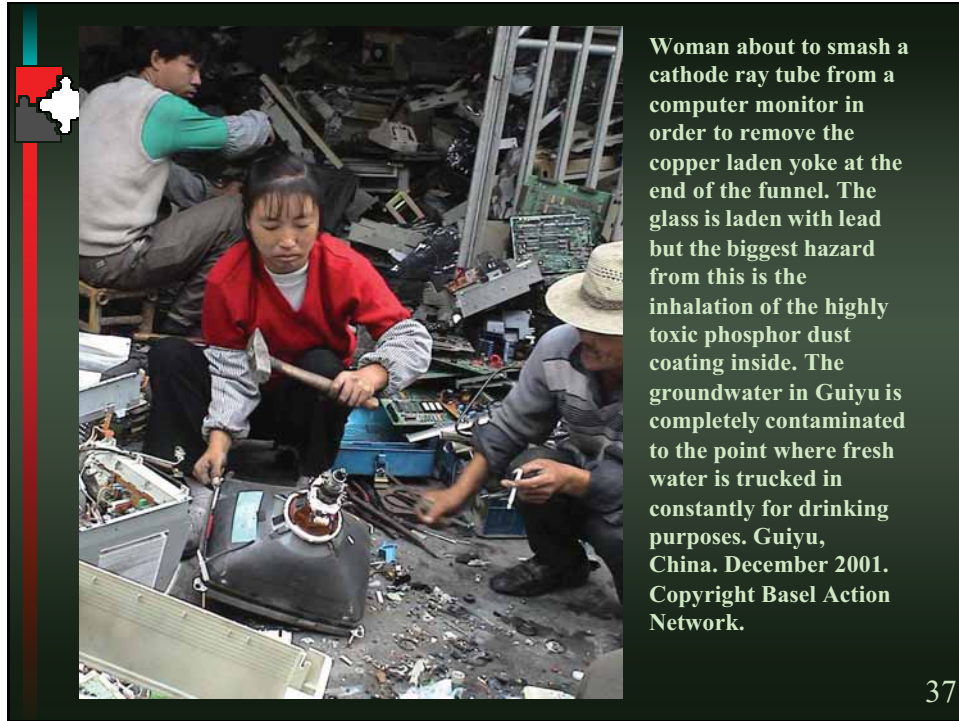
35

Of 75,000 chemicals in widespread use only 1500 have been tested for carcinogenicity.....

National Academy of Sciences, 1983, 1999



36



Migrant child from Hunan province sits atop one of countless piles of unrecyclable computer waste imported from around the world. Guiyu, China. December 2001. Copyright Basel Action Network.



39



Just some of the many labels found on computers and monitors which indicated to investigators where each load of computers originated. Guiyu, China. December 2001. Copyright Basel Action Network.

40







We must act on facts, and on the most accurate interpretation of them, using the best scientific information.

This does not mean we must wait for certainty

A graphic of a construction barrier. It features a black and yellow striped base. On top of the base are two circular lights, one red and one orange. Above the lights is a grey rectangular sign with the word 'UNDER' in white capital letters. Below the base is another grey rectangular sign with the word 'CONSTRUCTION' in white capital letters.

44

## San Francisco, Precautionary Principle Legislation, 2003

- Public has a right to know
- Government has a duty to assess publicly the full environmental and economic costs of alternative policies
  - Safe purchasing/shopping
  - Assessing alternatives openly
  - Evaluating policies and outcomes regularly based on developing science

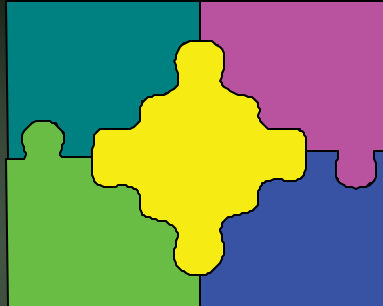
45

## Changing the Burden of Proof



- “We have become the bodies of evidence” — Nancy Evans
- People should not be treated like laboratory rats
- How much proof do we need?

46



*Environment is one piece of the health puzzle that can best be changed by social policy*

## Time for Girlcotts



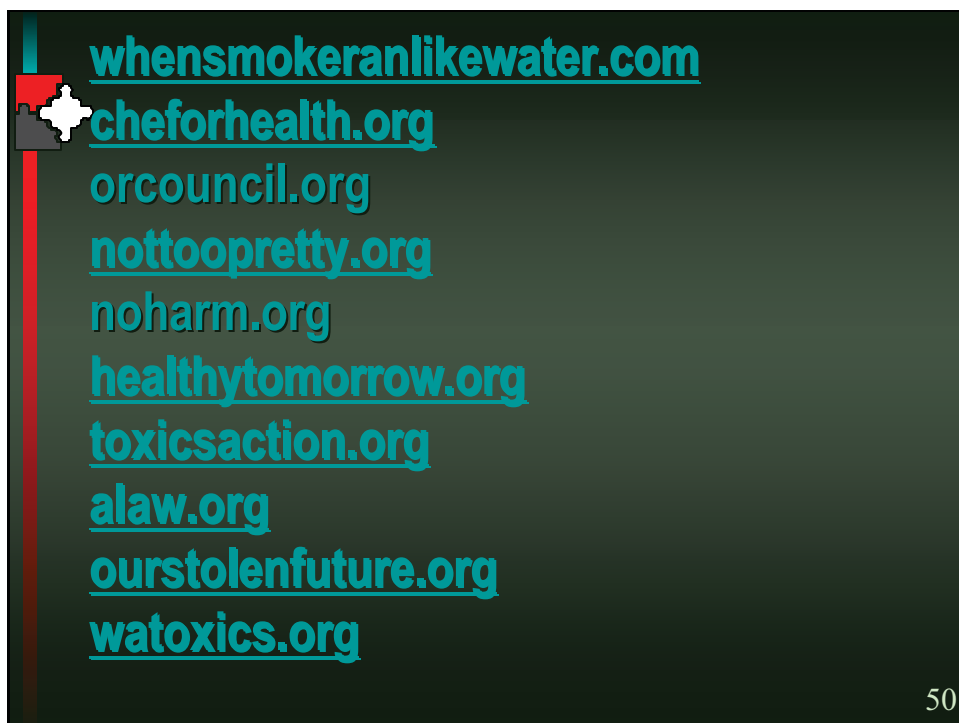
- | Boycott means “NO”
- | Girlcott means “YES”
  - Using purchasing power to create markets for cleaner, greener, safer, and healthier products

48





49



50