



The Ecology of Breast Cancer with Ted Schettler

Presented by:

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BREAST
CANCER
ACTION



Agenda

- Summarize the literature to date on breast cancer and the environment
- Discuss key finding
- Explore policy implications



Our Mission

Breast Cancer Action carries the voices of people affected by breast cancer in order to inspire and compel the changes necessary to end the breast cancer epidemic.

BCAction's Strategic Priorities

(1) Putting Patients First



(2) Creating Healthy Environments



(3) Eliminating Social Inequities



Ted Schettler, MD MPH



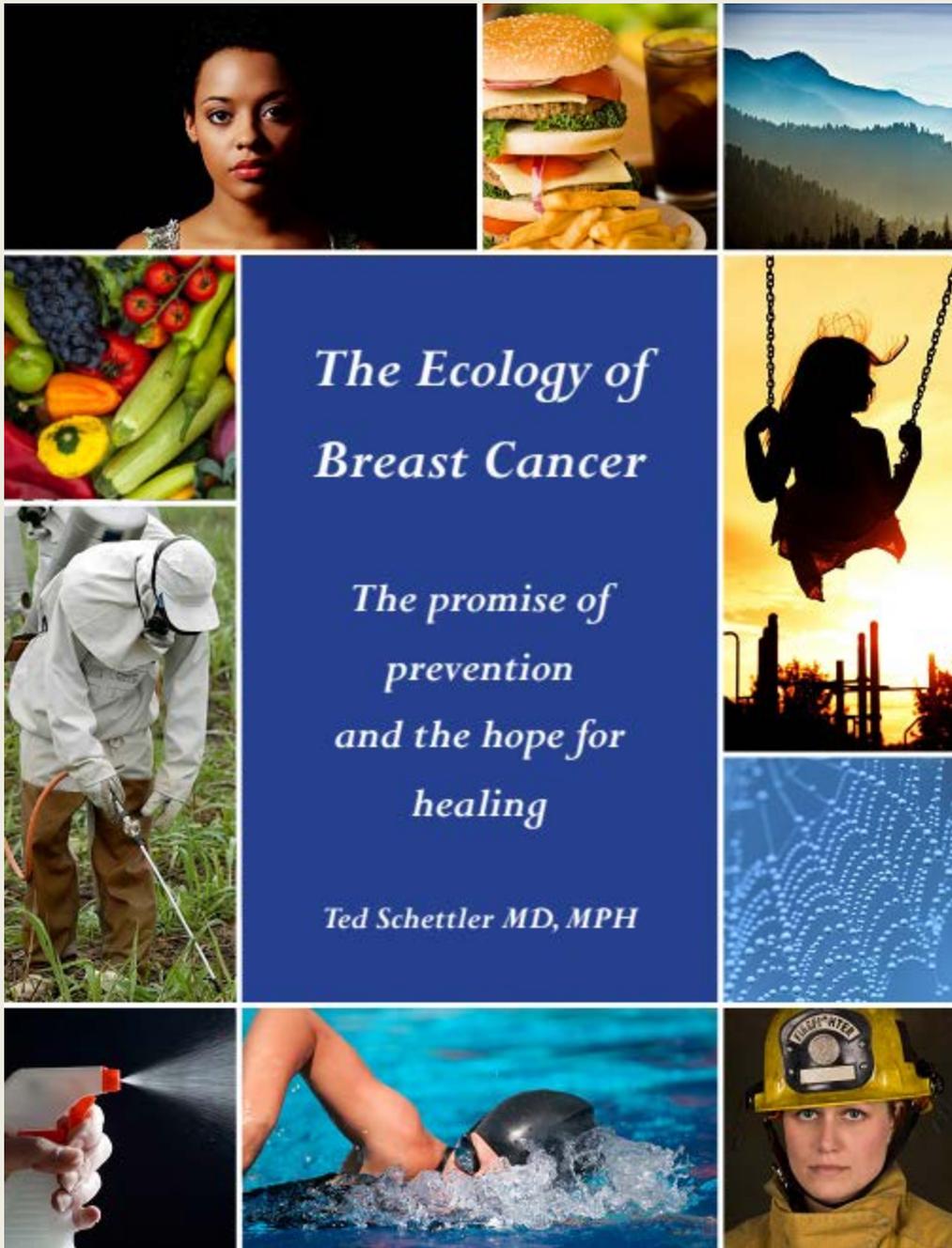
Science Director
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The Ecology of Breast Cancer: The Promise of Prevention and the Hope for Healing

Ted Schettler MD, MPH

Science and Environmental Health
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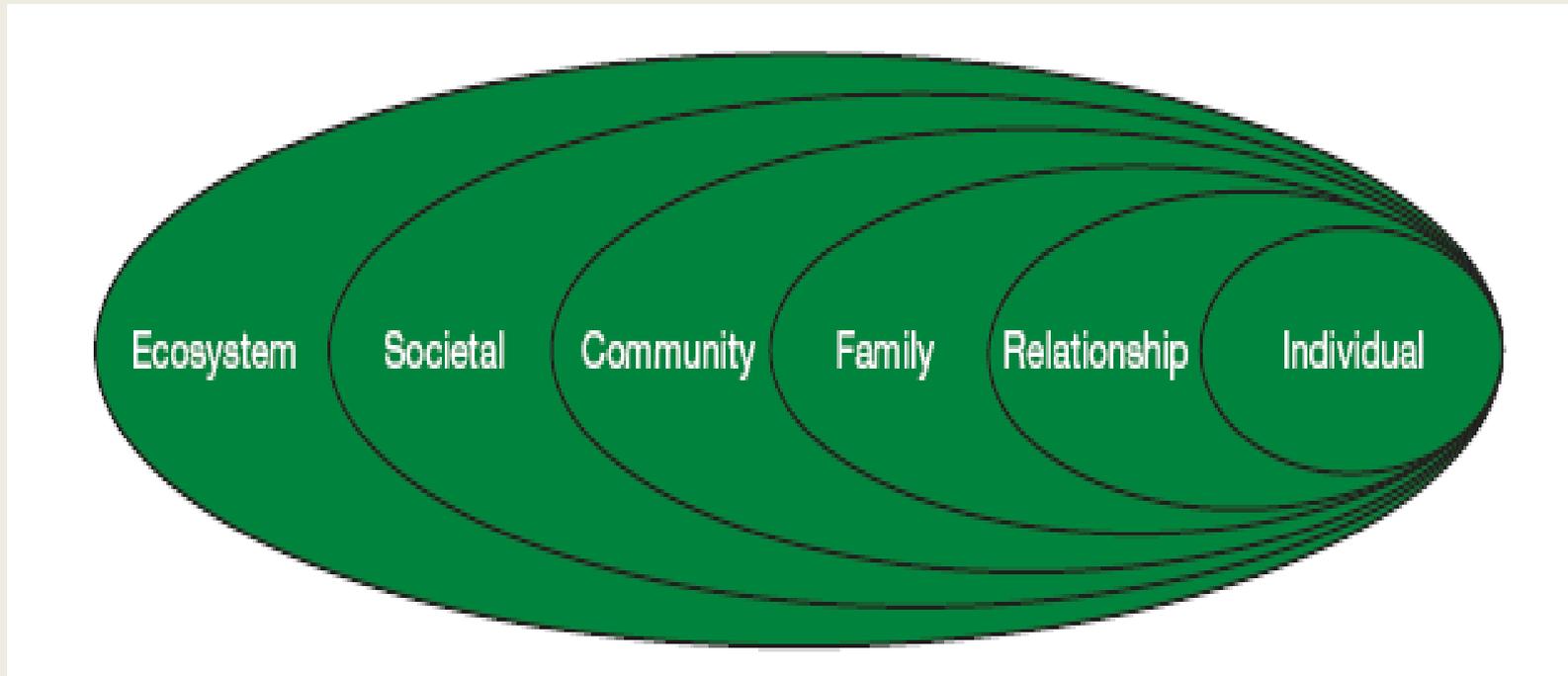
Outline

- An ecologic framework
- Looking within the complexity
 - Generally accepted risk factors
 - Diet, nutrition
 - Exercise, physical activity
 - Environmental chemicals
 - The electromagnetic spectrum
 - Stress
- Designing for breast cancer prevention and improved outcomes

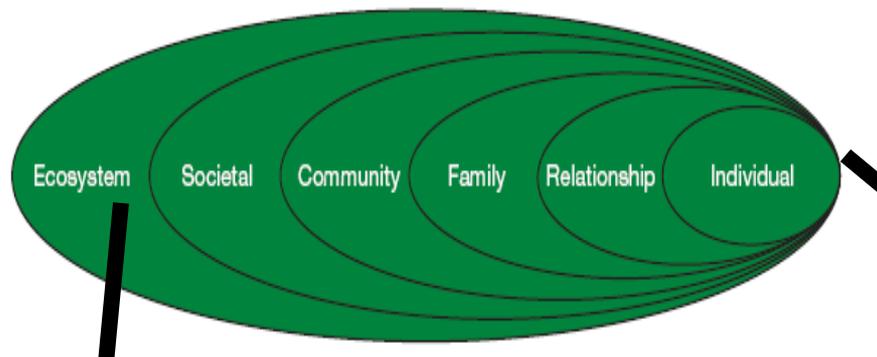
An ecologic framework

- Nested, multi-level
- Multi-dimensional; multi-factorial
- Interactions and relationships are primary
- History and time are important features;
 - What helps to explain changing breast cancer incidence and patterns?
 - Early life events can influence vulnerability or resilience
- Lessons from the ecological sciences

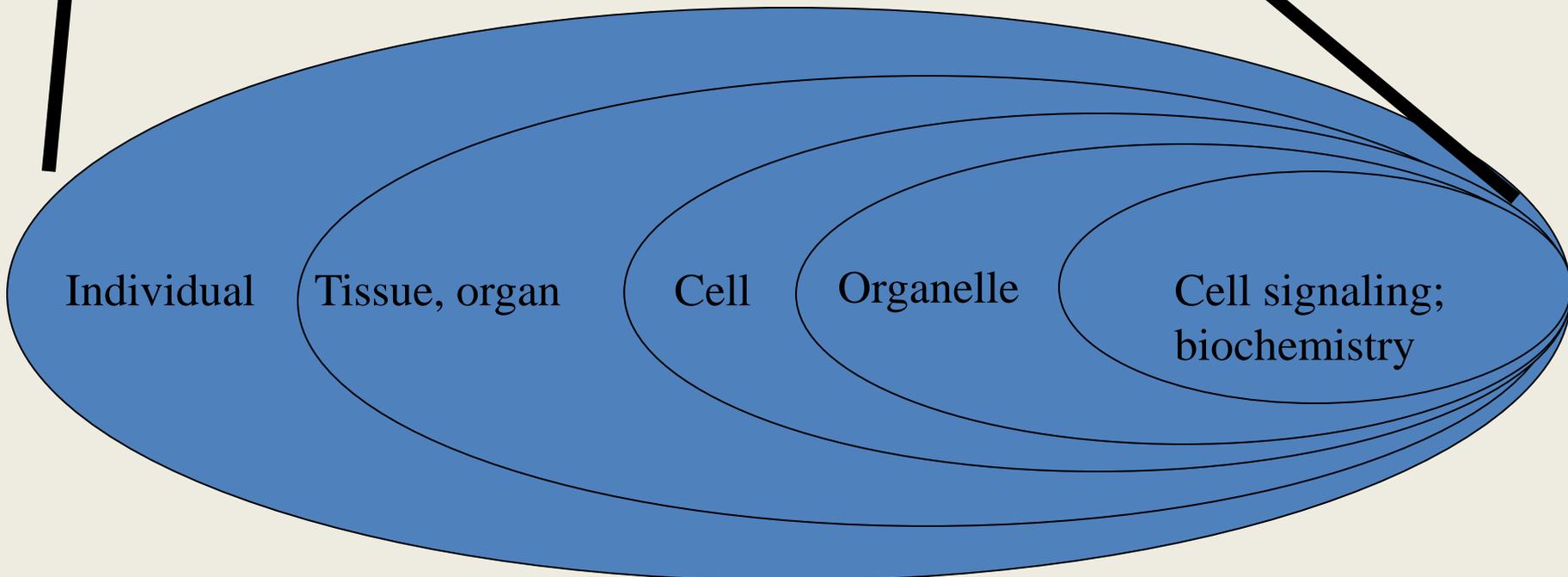
Ecological (eco-social) framework



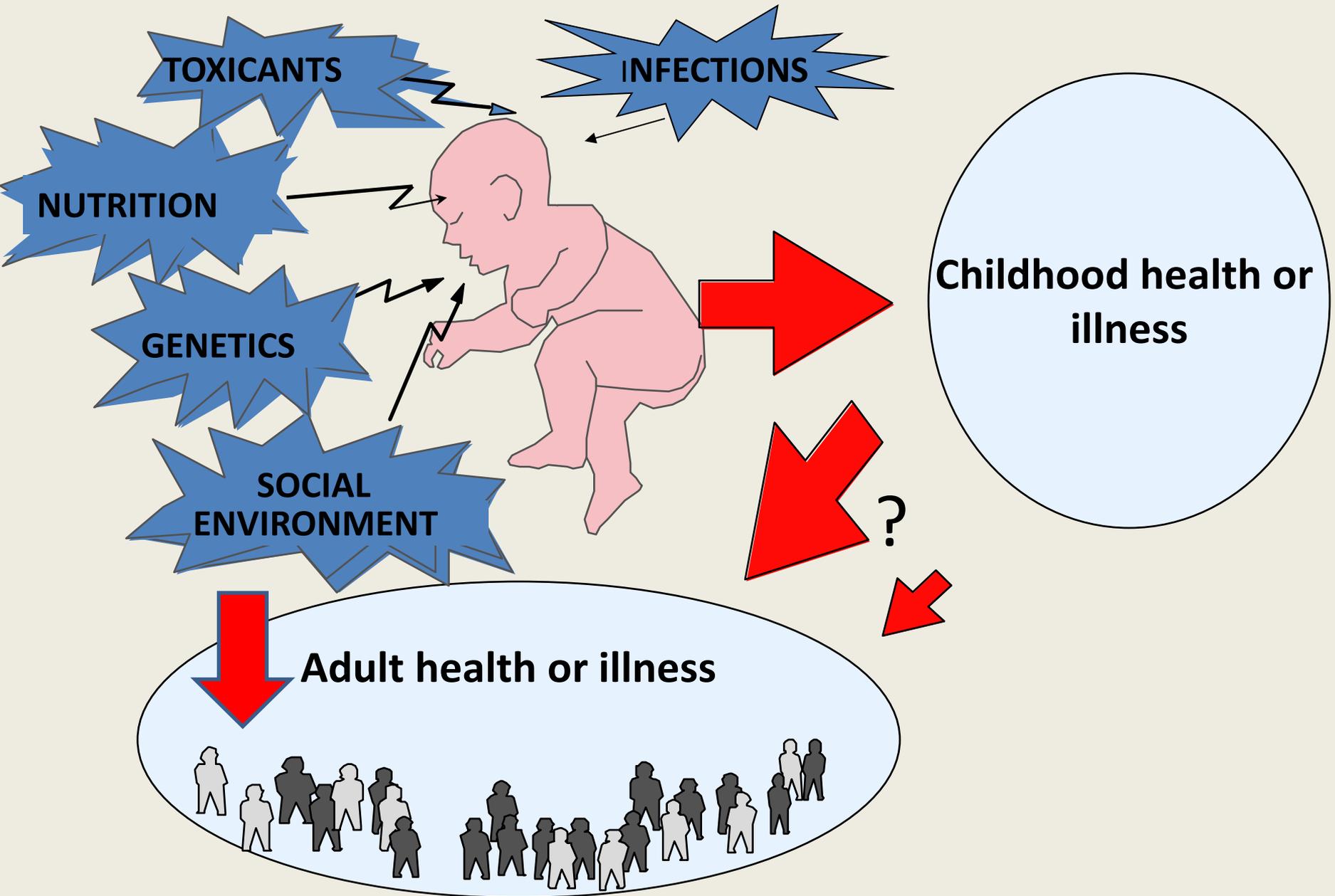
Multi-level “nesting”



The ecological framework:
“environment getting under the skin”



Lifecourse perspective



Early life experiences linked to later-life health, disease risks

What determines these?



Diethylstilbestrol (DES) *in utero* associated with increased breast cancer risk
Higher early life DDT exposures associated with higher breast cancer risk

**Environmental
Factors**



**Chronic
Disease**

Altered Pathways

Western Disease Cluster

- **Food system/Diet**
- **Environmental chemicals**
- **Built Environment/Transportation**
- **Social environment**
- **Natural environment**
- **Green space**

- **Inflammation**
- **Disrupted Insulin Signaling**
- **Oxidative Stress**
- **Endocrine disruption**
- **Gene mutation**
- **Altered gene expression**
- **Altered tissue development**

- **Diabetes**
- **Obesity**
- **Metabolic syndrome**
- **Cardiovascular disease**
- **Cancer**
- **Cognitive decline, dementia**

Diet and breast cancer

- Common limits of studies:
 - Until recently, most studies have focused on adult diet and risk
 - Most epidemiologic studies have included large preponderance of white women
 - Most studies have failed to address exercise as a confounder or effect modifier
 - No studies in people have examined whether diet modifies the response to environmental chemicals
 - Dietary pattern analysis is relatively recent

Summary: Dietary fat

- Higher amounts of saturated fat, trans fats, and animal fats modestly increase risk
- High omega 6/omega 3 FA ratio probably increases risk; may be some differences based on genetically-determined metabolic pathways for omega 6s
- High dietary maternal omega 6s in pregnancy may also increase risk in offspring (higher estriol, T levels)
- Substitution with omega 3s and olive oil is highly likely to be beneficial

Fruits, vegetables

- Higher intake associated with ↓ risk (~25%)
- WHEL interventional study of women with BC, higher baseline levels of carotenoids associated with improved prognosis
- Higher soy consumption ↓ risk; effect size larger in Asians than Westerners
- Mediterranean dietary pattern ↓ risk

Childhood, adolescent diet

- ↑ whole soy food in childhood and adolescence > 50% ↓ breast cancer risk
- ↑ meat in adolescence > 35% ↑ pre-menopausal breast cancer risk (NHS II)
- ↑ dietary vegetable protein, fat, nuts in girls 9-15 associated with ↓ risk of benign breast disease at age 30 (Growing Up Today Study)
- Some evidence that dietary meat advances the age of puberty; if so, studies of dietary meat and BC should not be routinely controlled for age of menarche

Exercise, physical activity

- Increased physical activity helps to prevent post-menopausal breast cancer (↓20-80%), colorectal, endometrial cancer (strong evidence)
- Evidence for reduction of pre-menopausal BC is not as strong; more consistent evidence of risk reduction in former athletes
- Exercise after diagnosis and treatment improves quality of life; many studies show reduced risk of all-cause or BC-specific mortality

Exercise, physical activity for cancer prevention

- 30-60 min. moderate-intensity exercise 5 days/wk; children and teens: 60 min daily
- Determinants of exercise levels:
 - Self-efficacy (confidence in ability): children, adolescents, and adults
 - Family and social support: particularly adolescents
 - Personal history of exercise; personal health; job strain; stress; overweight
 - Neighborhood walkability, design, access to recreation facilities, transportation availability, aesthetics (adults)

Environmental chemicals

- About 75 yrs. ago, dimethylbenzanthracene (DMBA) was first used to induce mammary gland cancer in lab rodents
- Study of chemicals in humans slow to develop
 - 1970-1980s: single-women hairdressers; PVC mfg; Swedish factory using an anti-rust oil; Canadian GE lamp mfg.—higher incidence/mortality from breast cancer
- Over 200 chemicals are mammary gland carcinogens in animal studies
- Increasing evidence in epidemiologic studies

Environmental chemicals, pharmaceuticals

- Institute of Medicine (IOM) report:
 - Sponsored by Komen; limited review
 - Strong evidence: HRT, current use of OCs, alcohol, tobacco smoke
 - Less strong but suggestive: other organic solvents, benzene, ethylene oxide, 1,3 butadiene, polycyclic aromatic hydrocarbons
 - Concerns but even more inconsistent or incomplete evidence: bisphenol A, cadmium, others

Endocrine disruptors and breast cancer

- Some chemicals can influence breast development and tissue architecture after developmental exposures
 - DES, bisphenol A, perfluorinated cmpds, dioxin
- These changes in mammary gland development may increase susceptibility to cancer in adulthood

Vitamin D and breast cancer

- Animal and *in vitro* studies support a role for vitamin D
 - low dietary levels increase mammary gland tumors after exposure to carcinogen
 - Vitamin D reduces aromatase levels, promotes cellular differentiation and apoptosis in breast tissue
- Most but not all studies find lower levels of vitamin D associated with higher risk of BC
- A prospective study in Bogota found low vitamin D levels predictive of early onset puberty

Vitamin D

- Endocrine Society (>30 ng/mL 25(OH)D) and Institute of Medicine analysis (> 20 ng/mL) disagree on what constitutes an adequate level
- Inadequate levels of vitamin D are common
- American Academy of Pediatrics recommends that all infants receive vitamin D supplement
- ACOG recommends testing women at risk of low vitamin D and supplementing as needed

Radiation, electromagnetic fields

- Ionizing radiation well-recognized risk factor
- Extra low frequency (ELF-EMF): evidence for BC is inconsistent.
 - 2001 meta-analysis: higher ELF-EMF exposures associated with 12% inc. risk in women and 37% inc. risk in men
 - More recent meta-analysis: no increased risk in women
- No studies of radio frequency EMF (cell phones, towers, other wireless technologies) but anecdotal reports of breast cancer in women who carried cell phone in bras
- Advice regarding reducing exposures in book

Stress

- Chronic stress or severe acute stress could plausibly accelerate the growth of an undiagnosed or treated tumor through a variety of mechanisms; (*e.g., altered hormone levels, immune function, inflammation, changes in gene expression*)
- Certain individuals and groups of people experience lifelong, chronic stress from personal, community, societal level factors; e.g. racism, fear of violence, socioeconomic circumstances, etc. (direct and indirect effects)

Stress and breast cancer

- Stress reduction improves quality of life after diagnosis and treatment
- In some studies, stress reduction as part of an integrated approach to breast cancer treatment delays recurrence and improves survival

Designing for breast cancer prevention and improved outcomes

Making sense of complexity

- Historical, life-course perspective
- Medical, behavioral interventions AND multi-level ecological interventions; public health thinking
 - Opportunities: individual, family, community, society
 - Shift system dynamics (re-design the terrain) making breast cancer less likely
 - Understanding cause-effect relationships will always be clouded by some degree of uncertainty
 - This should not be used as an excuse not to act, based on what we do know

Opportunities across the life-course

- Diet, nutrition, the food system, food access
- Exercise, physical activity, built environment
- Reduction and elimination of exposure to hazardous chemicals potentially linked to BC; more than alcohol, tobacco, HRT, oral contraceptives; occupational exposures
- Optimize vitamin D levels (not too much)
- Avoid unnecessary radiation exposure
- Stress management; sleep; shift work

Who?

- Individuals
- Health care institutions and systems
- Public health professionals and organizations
- Governments, legislators
- Schools
- Workplace
- Farmers; farm and agricultural policy
- City planners

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Review resources from presentation

- Download The Ecology of Breast Cancer e-book: www.sehn.org
- Breast Cancer and the Environment: A Life Course Approach: www.iom.edu/Reports/2011/Breast-Cancer-and-the-Environment-A-Life-Course-Approach
- Safer Chemicals, Healthy Families www.saferchemicals.org
- Science & Environmental Health Network www.sehn.org
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