Environment and breast cancer study: From basic research to outreach

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Banita Bailey
Breast Cancer and the Environment Research Program (BCERP)

The goals of the BCERC Program were to:

• Compare the molecular changes that occur in normal breast development across the life-span to changes that occur when environmental exposures are introduced;

• Conduct epidemiologic studies of the timing of female pubertal events, including the onset of breast development, age at menarche, and environmental and genetic factors that may affect pubertal maturation;

• Integrate scientific information on the development of the mammary gland and exposure-induced changes in order to construct public health messages for young girls and women who may be at increased risk for breast cancer.
Endocrine disruptor: Bisphenol A (BPA)

• Production of 1.6 billion pounds in North America.

BPA is ubiquitously present in the environment.
Hypothesis:

Fat in Cultural Diets

In utero exposure

Bisphenol A

Altered epigenome, gene expression and hormones

Steroid hormones

Leptin

Adiponectin

Adipokines

Leads to changes in cell behavior and morphology => Increased BCa risk
Aim 1: What is the most effective BPA dose that can synergize with a high-fat-butter diet (HFB)?

<table>
<thead>
<tr>
<th>Reference Dose By USEPA</th>
<th>Dose</th>
<th>DMBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFB + 0 BPA</td>
<td>Control diet</td>
<td>n=11/group</td>
</tr>
<tr>
<td>HFB + 2.5 BPA</td>
<td>Control diet</td>
<td>n=11/group</td>
</tr>
<tr>
<td>HFB + 25 BPA</td>
<td>Control diet</td>
<td>n=33/group</td>
</tr>
<tr>
<td>HFB + 250 BPA</td>
<td>Control diet</td>
<td>n=22/group</td>
</tr>
<tr>
<td>HFB + 2500 BPA</td>
<td>Control diet</td>
<td></td>
</tr>
<tr>
<td>HFB + 0.5 EE2</td>
<td>Control diet</td>
<td></td>
</tr>
</tbody>
</table>

Control Diet

Control diet

n=11/group

n=11/group

n=33/group

n=22/group

Dose is in µg/Kg B.W.

One animal per litter was used
### Aim 2: Which type of fat is harmful or protective in combination with BPA?

<table>
<thead>
<tr>
<th>Acclimation (14 days)</th>
<th>Mating (&lt;=10 days)</th>
<th>Gestation (23 days)</th>
<th>Lactation (21 days)</th>
<th>DMBA</th>
<th>P50</th>
<th>P140</th>
</tr>
</thead>
<tbody>
<tr>
<td>-51</td>
<td>-37</td>
<td>-27</td>
<td>P0</td>
<td></td>
<td>P21</td>
<td></td>
</tr>
<tr>
<td>Control diet</td>
<td>Control diet</td>
<td>Control diet</td>
<td>Control diet</td>
<td>P50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AIN + 25 BPA</td>
<td>Control diet</td>
<td>Control diet</td>
<td>Control diet</td>
<td>P50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HF0</td>
<td>Control diet</td>
<td>Control diet</td>
<td>Control diet</td>
<td>P50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HF0 + 25 BPA</td>
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<tr>
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<td>Control diet</td>
<td>Control diet</td>
<td>P50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

n=15/group
Summary of our finding

• BPA (25μg/Kg BW) in the presence of butter diet (HFB) showed significant higher tumor incidence and lower percentage of tumor-free survival when compared with butter diet alone.

• HFB lowers BPA’s lowest observed adverse effect level (LOAEL) by 10 times (25μg/Kg BW, non-monotonic dose-response).

• HFB shifts the cancer-susceptibility window back to Day 50.
Research and Outreach Team

Windows of Susceptibility
Breast Cancer Risk

http://www.eh.uc.edu/mythfactchoices/

Dr. Shuk-Mei Ho

Traci Metzger

Dr. Marian Miller  Dr. Linda Levin  Dr. Vinothini Janakiram  Dr. Ricky Leung  Banita Bailey RN
Outreach activities

Book Bag
Tags
Evaluation

Topics you want addressed
- High fat diet
- Estrogens
- Epigenetics
- Heritable risks
- Breast cancer
- Bisphenol A
- Sweeteners
- Other

Quality
- Poor
- Great

Book Bag:
- Durability
- Appeal
- Information
- Artwork
- Usefulness

Coffee Talk

Check the recycle code
- D&C Red 6
- Ethylparaben

Toxin-free lip gloss 4 me
- Methylparaben
- Aluminum hydroxide
- Sulfate
- Phenoxyethanol

Safer Choices
- Pintnates bisphenol A
Newsletters
Aim: To survey breast cancer survivors, supporters and families with respect to their interest in, and knowledge of, the potential impact of epigenetics on health.

<table>
<thead>
<tr>
<th>Question</th>
<th>Agree (%)</th>
<th>Disagree (%)</th>
<th>DK (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Damage from the environment to my mother was not transmitted to my child</td>
<td>19.5</td>
<td>54.9 (C)</td>
<td>25.6</td>
</tr>
<tr>
<td>2 My diet affects my child only while I am pregnant with her</td>
<td>24.7</td>
<td>61.5 (C)</td>
<td>13.8</td>
</tr>
<tr>
<td>3 My daughter is not affected by her fathers eating habits</td>
<td>60.1</td>
<td>12.6 (C)</td>
<td>27.3</td>
</tr>
<tr>
<td>4 My daughters DNA is not affected by her fathers drinking habits</td>
<td>18.5</td>
<td>63.6 (C)</td>
<td>18.0</td>
</tr>
<tr>
<td>5 If I drink during pregnancy, I can only harm my child but not my grandchild</td>
<td>14.8</td>
<td>67.1 (C)</td>
<td>18.1</td>
</tr>
<tr>
<td>6 My smoking affects the birth weight of my son but not his DNA</td>
<td>15.5</td>
<td>61.8 (C)</td>
<td>22.7</td>
</tr>
<tr>
<td>7 My diet does affect my daughter and my granddaughter</td>
<td>61.4 (C)</td>
<td>19.3</td>
<td>19.3</td>
</tr>
<tr>
<td>8 A low fat diet during pregnancy helps lower my sons breast cancer risk</td>
<td>26.7 (C)</td>
<td>12.7</td>
<td>60.6</td>
</tr>
<tr>
<td>9 If I don’t get breast cancer, my daughter won’t get it either</td>
<td>1.6</td>
<td>91.9 (C)</td>
<td>6.4</td>
</tr>
<tr>
<td>10 Identical twins have the same risk for disease</td>
<td>27.7</td>
<td>39.0 (C)</td>
<td>33.3</td>
</tr>
</tbody>
</table>

Note: The correct response is indicated by (C) and shading for (DK) to each question.

- On a sliding scale of 1 – 5 with 5 being the most interested, 3.5 was the mean interest levels.
- Most individuals did not recognize maternal diet and environment were relevant for breast cancer risk in male offspring.
- 40% of individuals between 14 - 19 yo preferred to be educated with videos.
- 30% of individuals 45-54 preferred emails and links.
Our website

Windows of Susceptibility and Breast Cancer:
Department of Environmental Health outreach with Pink Ribbon Girls

Breast Cancer: Susceptible Window of High Fat diet and Bisphenol A Programming of Breast Cancer Risk (1U01 ES01480) Dr. Shuk-mei Ho, PI. This grant has joined with Pink Ribbon Girls of Cincinnati to provide an educational outreach for helping others reduce their breast cancer risk.

February Newsletter  Environmental Triggers: worry over-eating smoking

Triggers.................................1
Q&A'S....................................2
New short videos.....................4
Fried rice..............................5
Wordsearch - bisphenols...........6
Coffee Talk............................9
Memory game - bisphenols.......10
Nutrient Density - rice.............11
Jigsaw puzzles - Valentine......12
Craft pattern..........................13
Yoga.....................................17

Newsletter Archives
MISSION
TO: Prevent Breast cancer

The phrase "environmental triggers" is not new to some of us. Those with asthma, acne, arthritis, migraines, insomnia, and addictions are well aware of them. All these behaviors and many more can be brought on by some elements in the environment. BUT, how many of us recognize those cues in our environment and understand how they trigger our behavior.

NPR produced a short program on addiction and breaking addiction. It made much sense, and was so insightful. The environment has important triggers for addictive behavior. The overriding theme of the newsletters of this outreach has been in defining the ENVIRONMENT and relating that to disease generally, more specifically, BREAST CANCER,
Online Games

Wordsearch puzzles

Word search

Bisphenol regulation — FDA

Crossword puzzles

50 risk factor facts
for Breast Cancer - crossword puzzle

Memory matching game

8 Great to-dos to reduce breast cancer risk

Jigsaw puzzles

Great 8 rap and videos and memory game to reduce breast cancer risk.