Endocrine Disruptors & the Mammary Gland: Reflections from a summer research program

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Great Neck Breast Cancer Coalition (GNBCC)

- An organization that advocates breast cancer prevention research
- The Scientists & Scholars program allows students to work in a university lab
  - Learn:
    - Essential research skills/techniques
    - Mouse mammary gland
    - Endocrine disruptors
    - Breast Cancer
Breast Cancer

- An abnormal growth/proliferation in breast cells
  - Can spread to other organs
    - bone, brain, liver tissue
  - Connection: Our mammary glands are dependent on, and very susceptible to, hormones
    - Estrogen influences the development of breast tissue
Breast Cancer & the Great Neck Connection

Breast Cancer Relative Incidence by State:
- 50 to 100% above expected
- 15 to 49% above expected
- Within 15% of expected
- 15 to 50% below expected
- More than 50% below expected
- Very sparse data
- Rates not available
Connections between the environment & cancer
Endocrine Disruptors

- Chemicals/Substances that affect the function of the endocrine system
  - Interfere with how hormones act, often by mimicking or blocking the actions of the hormone in the body
  - **Xenoestrogens** are endocrine disruptors that mimic estrogen
Endocrine disrupting chemicals can influence the risk of breast cancer.
Several examples

- DES & breast cancer
- DDT & breast cancer
- Air pollution & breast cancer
Using the mouse as a Model Organism

Similar mammary gland structure

Normal development is well characterized

Easy to expose

Short gestation period

The mouse predicted effects of endocrine disruptors later seen in people
Mouse Mammary Gland: Stages of Development

- Pre-Pubertal
- Pubertal
- Adult
- Pregnancy/Lactation
- Involution

Courtesy of Durga Kolla
What did we study?

1. Effect of early exposure to BBP on female mammary gland at puberty
2. Effect of early exposure to BBP on female mammary gland in adults
3. Effect of early exposure of BBP on male mammary gland
4. Effect of early exposure to oxybenzone on the responsiveness of females to hormones.
Exposures: Two Xenoestrogens

- Butyl Benzyl Phthalate (BBP) & Oxybenzone
  - BBP: Found in commonly used plastics (PVC)
    - Used to increase flexibility
  - Oxybenzone: Found in cosmetics (sunscreen & lotion)
    - Used to absorb UVA rays (radiation)
Effect of early exposure to BBP on female mammary gland at puberty

Measurements:

- Total Area of Mammary Gland
- Ductal Extension
- Average Area of all the TEB’s
- Total Number of TEB’s
Effect of early exposure to BBP on female mammary gland in adults

Measurements:

Grid analysis of ducts, terminal ends, and alveolar buds

Width measurement of ducts
Effect of early exposure of BBP on male mammary gland

- Method (measurement)
  - Number of trees
  - Area of the trees
  - Number of branching points
  - Number of TEBs
Effect of early exposure to oxybenzone on female response to hormones.
These studies suggest...

BBP and Oxybenzone are endocrine disruptors that affect estrogen-sensitive organs.

- Female mice that are exposed to BBP have a larger mammary gland than the normal mice at puberty.
- Female mice that are exposed to BBP have thinner ducts than the normal mice in adulthood.
- Male mice that are exposed to BBP have a smaller mammary gland than the normal mice.
- Female mice exposed to Oxybenzone have abnormal uterine responses to estrogen.
Endocrine disruptors: what can individuals do?

- As individuals, we can be more aware of the harmful chemicals in our daily products
  - Read the label of products
  - Use products that don’t include endocrine disruptors
  - Spread awareness to other people
Endocrine disruptors: what should society do?

- Limit the use of plastics
  - Do we really need this much plastic in our lives?
- Replacing harmful chemicals in our products
  - Find truly safe replacements: same properties but with fewer risks
- Spreading awareness
  - We can improve as a community
What this research opportunity taught us

- Brought awareness to the harmful substances we were putting in our body
  - A product free from **one endocrine disruptor doesn’t** make it ‘endocrine disruptor free’
- We learn important research skills including techniques used in the medical field
  - Staining slides using Hematoxylin & Eosin
  - Preparing whole mount samples
  - Using different microscopes
- We got to experience college life for four weeks
  - Making new friends
  - Dorming with each other
  - Meeting new mentors
  - Eating in dining halls
  - Organizing our time
To future GNBCC Interns

- It is an amazing opportunity
  - Learn more about our environment
    - The negative impact we have on the earth and how these impacts affect human health
  - Develop new skills as a researcher, a scientist, and a human being
  - Discover more about university life, and grow as an individual
  - **To make a change**
    - Your research might not go in a scientific journal but it does help researchers to answer their questions and address hypotheses
    - You can present your work at a scientific conference
Summary

- Study the mammary gland and endocrine disruptors in UMASS Amherst: Vandenberg Lab
- Observe/Research the effect of BBP & Oxybenzone in mouse mammary gland
  - Both Oxybenzone and BBP have endocrine disrupting properties
- Bring more awareness into endocrine disruptors
  - Our actions affect the environment and our future
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