Introduction

In 1990, alligators in Lake Apopka, Florida provided the evidence forewarned by Rachel Carson in her classic book *Silent Spring*, written in 1962. She was the first to proclaim to the public the pending health and wildlife problems are created by unregulated pollution. Her book empowered scientists to investigate the probable role of synthetic chemicals in causing abnormalities and diseases in humans and wildlife.

Rachel Carson's warning signs came to light in 1990, upon examination of an alligator population living in Lake Apopka, Florida. The evidence exhibited in the Lake Apopka alligators entailed higher than normal egg mortality and severe reproductive system abnormalities in male and female alligators. A research team headed by L. H. Guillette linked these problems to some type of environmental contaminant that was disrupting the alligator's endocrine system. Further examination revealed that large levels of the pesticide DDT and an industrial by-product, dicofol, were accidentally released into the lake by a chemical company in 1980.

A variety of aquatic animals in similarly polluted environments showed developmental defects related to endocrine disruption. Amphibians, fish, and turtles have shown sexual deformations and produced defective offspring when exposed to known endocrine disrupters. Researchers knew as far back as 1938 that various pollutants found in water caused birth defects in laboratory animals. These chemicals damaged the animals by disrupting their endocrine systems. A team headed by J. A. McLachlan in 1996 confirmed the endocrine disrupter problem by comparing laboratory studies on turtles to abnormalities seen in turtles living in polluted waters.

Recent studies conducted in Asia, Europe, and the United States indicate that endocrine disrupters may be impacting human health. Higher incidences of breast cancer in certain regions are correlated with high levels of suspected endocrine disrupters in the drinking water. Similar studies link declining sperm counts to the intake of endocrine disrupters in food and water.

Endocrine disrupters are not regularly tested for in natural bodies of water. Traces of pesticides and other organic pollutants have been detected in drinking water supplies in many communities along the Gulf Coast and southern Mississippi River. There is also evidence that suspected endocrine disrupters are entering the diet on fruits and vegetables having pesticide residues. Although the levels of endocrine disrupters in the diet are minuscule, there is much concern about their prolonged intake in food and water. Immediate effects on human health may not be readily visible. After all, it took ten years for researchers to notice the severe defects in the Lake Apopka alligators.

Background

What Are Endocrine Disrupters?

Endocrine disrupters are a group of organic chemicals that act like steroid hormones on animal cells. Steroids are involved in the development, growth, immune system function, kidney function, and sex determination in many types of animals. The most studied types of endocrine disrupters are chemicals that disrupt estrogen function. Estrogen is produced primarily in the ovaries and testes of animals. However, they are produced in greater amounts in females and influence growth and maintenance of the female reproductive system. They also help with the development and function of other body parts such as arteries, bone, brain, and skin.
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Estrogen disrupters can be naturally occurring or synthetic chemicals. Natural disrupters are found in a variety of fungi and plants. Those found in plants are called phytoestrogens. Plants use these chemicals as growth regulators and as a defense against plant-eating animals. They are usually taken in by humans in the diet. Phytoestrogens can enter water in areas where there are large amounts of decaying plant matter. Recently, many women have been taking plant supplements in an attempt to gain medical value from the phytoestrogens. However, there is much debate about their safety. Natural estrogens are more potent than synthetic estrogens and their levels are not consistent in medications made from plant extracts containing phytoestrogens.

Synthetic estrogens include pesticides such as DDT and industrial chemicals such as PCBs and dioxin. Large amounts of these chemicals have accumulated in the environment even though they have not been commonly used for over twenty years. Other pesticides, such as aldrin, chlordane, and dieldrin, also have acted as estrogen in many animals. Biphenols, which are associated with plastics manufacturing, are commonly found synthetic chemicals shown to be endocrine disrupters.

**Distribution of Endocrine Disrupters**

Researchers are actively pursuing the prevalence and distribution of endocrine disrupters in the environment and diet. Endocrine disrupters are being detected in foods, drinking water supplies, and the air because of the liberal use of pesticides in lawn care, golf courses, and agriculture. In addition, aggressive methods for controlling insects that spread animal and human disease have released endocrine-disrupting pesticides into lakes, rivers, and the oceans worldwide. Accidental and intentional releases of industrial chemicals, as in the Lake Apopka event, are other sources of endocrine disrupters in water and soil.

**Problem**

Large bodies of water, such as the Gulf of Mexico, are prime areas for the accumulation of endocrine disrupters. Environmental estrogens, in particular, can build up in the Gulf. This is because the Mississippi River and other bodies of water that empty into the Gulf serve as "dumping grounds" for industrial chemicals, agricultural wastes, and urban water runoff. The Gulf of Mexico is a major source of drinking and recreational water for much of the U.S. population and is habitat to many species of protected organisms. It is also a region known for the production of much of the area's seafood. Endocrine disrupters in the Gulf States are already being associated with reproductive problems in amphibians, fish, and reptiles.

The impact of this on the overall ecology of the area is currently not under study. Its impact on human health has not been fully addressed by area legislators. Former New York Senator Alphose D'Amato urged the government to carry out an endocrine disrupter screening program through the Environmental Agency (EPA). The EPA started a program called the Endocrine Disrupters Screening and Testing Advisory Committee (EDSTAC) in 1998. However, to this date, little is known about the levels of endocrine disrupters in Gulf Coast waters.

**The Issues**

Pesticides and plastics have become an essential component of society worldwide. Try to imagine life in the United States without plastics. The costs of replacing plastic with other materials would
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be unimaginable today. Industries would have to resort to using wood products, glass, and metals, which would be a great financial burden to people and would further reduce those diminishing resources. As plastics have become the mainstay of product manufacturing, pesticides have become a necessity in agriculture and human health. Farmers and public health officials would have to make great sacrifices to eliminate pesticide use. Food yields and food quality would most likely drop with the discontinuation of pesticides. Diseases spread to animals and humans by insects would rise if pesticides were not used to control fleas, flies, mosquitoes, and ticks.

Environmental groups, scientists, and public health officials must now begin to evaluate the costs and benefits of using pesticides and plastics. They need to appraise alternatives to current pesticides and plastics in light of mounting evidence of environmental decay and declining human health.

References

Literature


Web Sites

1. Environmental Concepts Made Easy at http://e.hormone.tulane.edu/

Key Principles

1. Endocrine Disrupters
2. Water Pollution
3. Pesticide Effects
4. Wildlife Toxicology

Ethical Considerations

1. What is society willing to sacrifice when weighing the costs and benefits of using technology for human convenience?
2. How does society balance human needs versus the costs of environmental decay?
3. What is the feasibility of developing alternatives to current pesticides and plastics with the current evidence about endocrine disrupters?

Civic Engagement & Service Opportunities

1. Volunteer for a local community group involved in environmental monitoring.
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2. Write or e-mail your local politicians about proposing local policies that protect your area from estrogen disrupters.
3. Form a student group having an environmental preservation mission.
4. Set up a public forum at your school discussing the impact of estrogen disrupters in your area.

Learn more about community service as part of your educational enrichment by visiting the following websites: http://www.learnandserve.org/, http://www.servicelearning.org/.

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