PI227

UF UNIVERSITY of FLORIDA
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EPA's Endocrine Disruptor Screening Program (EDSP)[1]

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Introduction

Questions have been asked in recent years concerning the effects that certain chemicals may have on the endocrine system of humans and wildlife. Laboratory studies have produced evidence that show various chemicals disrupt the endocrine systems of animals. Other evidence has shown that the endocrine systems of certain fish and wildlife species have been affected by chemical contaminants. Do some of these same chemical contaminants also affect the human endocrine system? Do pesticides cause these types of effects? The relationship between human diseases of the endocrine system and exposure to environmental contaminants is both poorly understood and controversial. This document discusses EPA's screening program for potential effects to the endocrine system caused by pesticide exposure.

What is the endocrine system?

All birds, fish, and mammals possess an endocrine system. It's a complex system consisting of three basic components:

1. Glands, which include the following:
   - Hypothalamus gland
   - Pituitary gland
   - Thyroid gland
   - Adrenal glands
   - Pancreas
   - Gonads
2. More than 50 hormones produced by the glands that function as chemical messengers.
3. Receptors in various organs and tissues that recognize and respond to the hormones. The endocrine system is responsible forendocrine system. It's a complex system consisting of three basic components: regulating important biological processes, including metabolism, blood sugar levels, growth and function of the reproductive system, and the development of the brain and nervous system.

1. This document is PI227, one of a series of the Agronomy Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date April 2010. Visit the EDIS Web site at http://edis.ifas.ufl.edu.
2. F.M. Fishel, associate professor, Department of Agronomy, and director, Pesticide Information Office; Institute of Food and Agricultural Sciences; University of Florida; Gainesville 32611.

How does disruption of the endocrine system occur?

Some chemicals can mimic the effects of natural hormones:

- Causing the body to over-respond, e.g., the effects of growth hormones to increase muscle development.
- Causing a bodily response at the inappropriate time, e.g., insulin production when it's unnecessary.
- Causing a blockage of receptors from responding to the effects of hormones.
- Causing an overproduction or underproduction of hormones.

Some synthetic drugs, such as birth control pills, have been used intentionally to affect the endocrine system. However, attempts to regulate endocrine systems do not always have positive endocrine effects.

A notorious example of an endocrine disruptor with detrimental effects to humans was the use of the drug, diethylstilbestrol (DES), a synthetic estrogen. DES was used to block spontaneous abortion and promote fetal growth in pregnant women. It was later found that after female children of these women went through puberty that DES affected the development of the reproductive system, resulting in cases of vaginal cancer. Although now long banned, an estimated 5–10 million pregnant women and their children were exposed to DES prior to this discovery that prompted physicians to cease DES prescriptions. Use of DES as a growth hormone in agricultural livestock was also discontinued.

Rationale for EPA's EDSP Targeting Pesticides

All pesticide active ingredients are required to undergo extensive toxicological testing prior to being granted U.S. Environmental Protection Agency (EPA) registration. Some industrial chemicals have undergone extensive toxicological testing; however, it is unclear whether this testing has been adequate to detect the potential for both groups of these chemicals to be endocrine disruptors. Both the extent to which and the kinds of additional testing needed for the EPA to assess and characterize both human health and ecological risk remain uncertain. Recent legislation, including the reauthorization of the Safe Drinking Water Act (SDWA) and passage of the Food Quality Protection Act (FQPA), has mandated that such a screening and testing program be developed by EPA, with the overall objective being to reduce or mitigate risk to human health and the environment.

The EDSP Process

EPA's EDSP has been involved in a validation process for several tiers of assays with their accompanying protocols and the policies and procedures for use in the EDSP testing process. In late 2009, EPA issued the first test orders for pesticide chemicals to be screened for their potential effects on the endocrine system. At this same time, EPA made available the battery of scientific assays and test guidelines for conducting the assays, as well as a schedule for issuing test orders to manufacturers for 67 chemicals that will serve as the first group to enter the initial phase. Of the 67 chemicals, there are 58 pesticide active ingredients and 9 high production-volume chemicals used as inert ingredients (Table 1). Because this list of chemicals was selected on the basis of exposure potential only, it should not be construed or characterized as a list of known or likely endocrine disruptors.

The data generated from the screens will provide robust and systematic scientific information to help EPA identify whether additional testing is necessary, or whether other steps are necessary to address potential endocrine disrupting chemicals. Testing, conducted through the EDSP, will eventually expand to cover all pesticide chemicals. Now that screening is under way for the first group of chemicals, EPA is preparing to review the responses, evaluate the data, determine the potential of endocrine interaction, and recommend whether additional testing is necessary to guide further regulation.

Additional Information

Fishel, F.M. 2005. What are inert ingredients? UF/IFAS EDIS Document PI-44 (http://edis.ifas.ufl.edu/pi081). Viewed March 2010.

Olexa, M.T., L. D'Isernia, L. Minton, D. Miller, and S. Corbett. 2005. Handbook of Florida water regulation: Food Quality Protection Act. UF/IFAS EDIS Document FE589 (http://edis.ifas.ufl.edu/fe589). Viewed March 2010.

Olexa, M.T., L. D'Isernia, L. Minton, D. Miller, and S. Corbett. 2005. Handbook of Florida water regulation: Safe Drinking Water Act. UF/IFAS EDIS Document FE587 (http://edis.ifas.ufl.edu/fe587). Viewed March 2010.

External Links

Environmental Protection Agency –
http://www.epa.gov

EPA's Endocrine Disruptor Screening Program –
http://www.epa.gov/endo/

Table 1. Chemicals selected to enter the EDSP initial testing phase

Chemical	Primary Use(s)	Chemical	Primary Use(s)
2,4-D	Herbicide	Endosulfan	Acaracide / Miticide / Insecticide
Abamectin	Acaracide / Miticide / Insecticide	Esfenvalerate	Insecticide
Acephate	Insecticide	Ethoprop	Insecticide / Nematicide
Acetone	Inert	Fenbutatin oxide	Acaracide / Miticide
Atrazine	Herbicide	Flutolanil	Fungicide
Benfluralin / benefin	Herbicide	Folpet	Fungicide
Bifenthrin	Insecticide	Gardona (cis isomer) / tetrachlorvinphos	Insecticide
Butyl benzyl phthalate	Inert	Methamidophos	Acaracide / Miticide / Insecticide
Captan	Fungicide	Methidathion	Acaracide / Miticide / Insecticide
EPTC	Herbicide	Methomyl	Insecticide
Carbaryl	Insecticide	Methyl ethyl ketone	Inert
Carbofuran	Insecticide / Nematicide	Methyl parathion	Insecticide
Chlorothalonil	Fungicide	Metolachlor	Herbicide
Chlorpyrifos	Insecticide	Metribuzin	Herbicide
DCPA	Herbicide	Myclobutanil	Fungicide
Cyfluthrin	Insecticide	Norflurazon	Herbicide
Cypermethrin	Insecticide	o-Phenylphenol	Fungicide
Diazinon	Insecticide	Oxamyl	Insecticide / Nematicide
Dibutyl phthalate	Inert	Permethrin	Insecticide
Dichlobenil	Herbicide	Phosmet	Insecticide
Dicofol	Acaracide/Miticide	Piperonyl butoxide	Synergist
Diethyl phthalate	Inert	Propachlor	Herbicide
Dimethoate	Insecticide	Propargite	Acaracide / Miticide
Dimethyl phthalate	Inert	Propiconazole	Fungicide
Di-sec-octyl phthalate	Inert	Propyzamide / pronamide	Herbicide
Glyphosate	Herbicide	Pyriproxyfen	Insect Growth Regulator
Imidacloprid	Insecticide	Quintozene / PCNB	Fungicide
Iprodione	Fungicide	Resmethrin	Insecticide
Isophorone	Inert	Simazine	Herbicide
Linuron	Herbicide	Tebuconazole	Fungicide
Malathion	Insecticide	Toluene	Inert
Metalaxyl	Fungicide	Triadimefon	Fungicide
Disulfoton	Acaracide / Miticide / Insecticide	Trifluralin	Herbicide