Chemicals Found to Affect Male Reproductive System in New Way

By Hilary Melcarek

Toxicology and Industrial Health, Vol. 15, No. 1-2, 1999, with guest editor and World Wildlife Fund senior scientist, Theo Colborn, Ph.D., compiles studies on the effects of pesticides on the male reproductive system, and finds that some estrogen mimickers also have antiandrogenic (demasculinizing) effects. As far as scientists understand right now, antiandrogenic effects can take two forms: either a reduction in the amount of testosterone produced in the body, or a replacement by the chemical in the cell's receptor where a testosterone molecule would normally go. This introduces a whole new concern in that, up until now, scientists had found that certain chemicals are feminizing — they act like estrogen and this too can affect the male reproductive system. These new findings however, show that certain chemicals actually demasculinize, and can affect sperm counts and the structure of the prostate, or cause delayed puberty and extra nipples in males.

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In "Environmental antiandrogens: low doses of the fungicide vinclozolin alter sexual differentiation of the male rat," Earl Gray, Ph.D., (et al.) research biologist, Endocrinology Branch of the Reproductive Toxicology Division, Office of Pesticide Programs, EPA, found that malformations and reduced fertility were seen even at levels ten-fold smaller than levels otherwise known to cause effects, suggesting that there is no "safe" threshold for exposure.

Another study, "Dieldrin reduces male production and sex ratio in *Daphnia*," by Stanley Dodson, Ph.D.,(et al.) Department of Zoology, University of Wisconsin in Madison, found that exposure to the insecticide dieldrin causes a decrease in the production of male *Daphnia* (water flea), which may have long-term ecological effects.

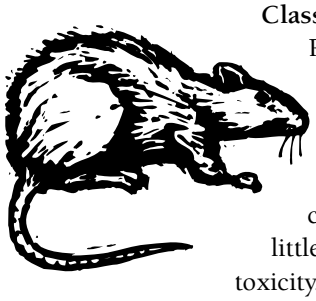
In a piece co-authored by Dr. Colborn, printed in the *Toxicology* journal, it was found that 60% of the poundage of all agricultural herbicides has the potential to disrupt the hormone or reproductive system. Environmental Media Services held a press breakfast in Washington DC on March 23, 1999 to alert the media to these new findings. The following excerpts from the above mentioned studies illustrate these findings. *For a copy of the studies send $8 to Beyond Pesticides/NCAMP, or contact Amy Kostant, Environmental Media Services, 1320 18th Street, NW, Suite 500, Washington DC 20036, 202-463-6670, ems@ems.org.*

Environmental antiandrogens: low doses of the fungicide vinclozolin alter sexual differentiation of the male rat

L. Earl Gray Jr., Joseph Ostby, Emily Monosson and William Kelce

Introduction

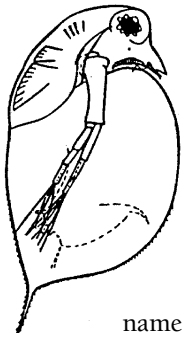
The fungicide vinclozolin (V) alters sexual differentiation in male rats in an antiandrogenic manner. Vinclozolin is a dicarboximide fungicide used in the control of *Botrytis cinerea, Sclerotinia scierotiorum*, and *Moniliniam* spp. on several fruits, vegetables, ornamental plants, and turfgrass. Administration of V to pregnant rats at 0, 100, or 200 mg/kg/day during the period of sexual differentiation (gestational day 14 to postnatal day 3) demasculinizes and feminizes the male offspring. Vinclozolin-treated male offspring display female-like anogenital distance (AGD) (distance from the anus to the genitals) at birth, retained nipples, cleft phallus with hypospadias (urinary tract does not end at tip of penis), suprainguinal ectopic testes (undescended testes), a blind vaginal pouch, epididymal granulomas, and small to absent sex accessory glands. In contrast, female offspring display no malformations or functional alterations.



Discussion: Environmental Antiandrogens: A 'New' Class of Endocrine-Disrupting Chemicals

Recently, concern has developed regarding the effects of these 'endocrine disrupting' toxicants on human reproductive function. To date, most of the discussion of developmental reproductive toxicity has focused on toxicants reported to possess estrogenic activity, with little consideration given to other mechanisms of toxicity. This focus must be expanded to include synthetic chemicals that act by competing with androgens for the

Androgen Receptor (AR). Antiandrogenic chemicals are not only diverse in structure, some that bioaccumulate have been found at high concentrations in wildlife and human tissues. Increases in the incidence of hypospadias and testicular cancer and reports of declining sperm counts in humans in some geographical areas have been linked to possible exposure to endocrine disruptors. It is apparent that *in utero* exposure to V induces some of these effects in the rat. It is likely that human males would be similarly affected if exposed to similar levels of the active metabolites of V during the critical period of reproductive development *in utero*.

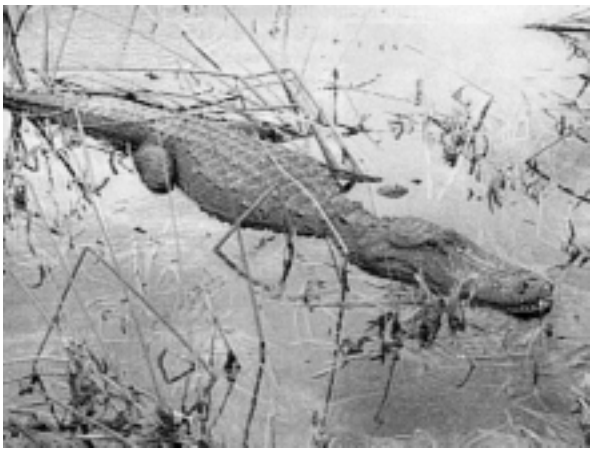


Dieldrin reduces male production and sex ratio in *Daphnia galeata mendotae*

Stanley I. Dodson, Christine M. Merritt, laura Torrentera, Katherine M. Winter, Christopher K. Tornehl and Kristin Girvin

Discussion: Aquatic Ecology

Chemicals that change *Daphnia* development or reproduction are clearly of ecological concern. *Daphnia* are ecologically important algae-consumers and fish-food in lakes all over the world. In particular, a decrease in the number of males has the potential of reducing *Daphnia*'s ecological success over many generations, because the genetic recombination associated with sexual reproduction allows a population to adapt to on-going environmental change. Any chemical that interferes with normal *Daphnia* production will also have indirect effects on water quality and fish production. Changes in water quality and fish production are also of concern for human health and well-being.



Some alligators in Florida have failed to develop sexually because pesticides and other toxics in the environment behave like hormones and disrupt normal patterns of growth and behavior.

Pesticide use in the U.S. and policy implications: A focus on herbicides

Polly Short and Theo Colborn

Introduction

Exposure to several herbicides, which have been in use for decades, has been associated with a range of adverse effects in humans, such as impaired development, non-Hodgkin's lymphoma, and prostate cancer. Others are suspected neurotoxicants, endocrine disruptors, and immune system suppressants. New herbicides have been introduced in part to replace older ones known to have adverse effects. However, little is known about the health effects of these modern herbicides, many of which have been in use only since the late 1980s and early 1990s. Although some herbicides may not harm animals, they can damage non-target plant species, altering biodiversity and indirectly affecting wildlife.

Global pesticide use trends and regulations

Pesticide Additives: Pesticide additives, often called inert ingredients, can be toxic. In fact, some chemicals are listed as an unidentified inert in one product, but are the active ingredient (AI) in another product. At least 394 inert ingredients have been or are currently registered as pesticidal AIs. Although a chemical may make up more than 90% of one product as an inert, it does not have to be identified by name as long as it is not highly toxic or technically the "killing agent." Only the total percentage of inert ingredients must be declared on the label. The EPA has long acknowledged that some inerts "may be more toxic or pose greater risks than the active ingredient."

Discussion

Five hundred and fifty-six million pounds of herbicide active ingredients were used in the U.S. in 1995, equaling over 2 lbs. per person and covering many regions of the country. Over 60% of all agricultural herbicides used in the U.S. are reported to disrupt the endocrine and/or reproductive systems of animals. These herbicides covered roughly 271 million acres of agricultural land, an area comprising 12% of the United States.

No new chemicals should be registered for use unless there is conclusive evidence that they do not cause unreasonable adverse effects on human, wildlife, and ecosystem health and there are technologies to detect the chemicals after they are released into the environment. Pesticide use reduction is also essential in order to slow the influx of chemicals in the environment. It has been estimated that pesticide use can be considerably reduced through an adoption of alternative techniques, such as integrated pest management, without reducing crop yields. Pesticide use reduction would diminish the indirect costs of pesticide use, such as pesticide poisonings, destruction of susceptible crops and natural vegetation, fishery and wildlife losses, evolved pesticide resistance, creation of secondary pest problems, etc.

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