

Endocrine Disruption—General Overview

Background

The endocrine system consists of glands that produce hormones that coordinate many aspects of physiology, including reproductive functions, in target tissues and cells that contain hormone receptors. Some manmade substances can bind to hormone receptors or otherwise modulate endocrine function and while many such substances also occur naturally, such phytoestrogens found in certain vegetables and grains. When such activity adversely affects human or environmental health, this undesired activity has been referred to as endocrine disruption. The generally agreed definition for endocrine disruptors is as follows:

“An endocrine disrupter is an exogenous substance that causes adverse health effects in an intact organism, or its progeny, secondary to changes in endocrine function.”

- European Workshop on the Impact of Endocrine Disrupters on Human Health and Wildlife (Weybridge, UK; 1996). European Union Report EUR17459.

A potential to interact with the endocrine system does not necessarily constitute a risk. This is dependent upon several factors, such as the timing, duration and extent of exposure (i.e., dose). In fact, the European Union Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE) states:

“It is important to realise that endocrine disruption is not a toxicological endpoint per se as is cancer or allergy, but that it is a descriptor for a functional change that may lead to adverse health effects. Rather, endocrine disruption should be seen in the context of well-established endpoints, primarily reproductive toxicity and impaired development.”

Endocrine Screening & Testing

In 1996, the United States Congress directed the U.S. Environmental Protection Agency (EPA) to develop a prioritization and screening program to evaluate potential endocrine disrupting compounds. This is a tiered program that contains 11 screening assays to comprise Tier 1, the general purpose of which is to identify substances with the *potential* to interact with the estrogen, androgen, or thyroid hormone systems. If the results of these screening assays and a weight-of-evidence assessment indicate a high potential to interact with the endocrine system, the compound may advance to Tier 2 where more extensive tests are conducted to determine if the compound produces adverse effects and to generate dose-response data for any effects observed. Although legislation mandating endocrine screening and testing was enacted in 1996, a great deal of effort was necessary to develop standardized and validated protocols in the years following. Test orders to evaluate specific chemicals were issued for the first time in late 2009. The results from these tests are intended to afford a rigorous examination of whether a compound is acting via an endocrine mediated mode of action.

Global Activity

Currently there is a large degree of international cooperation on advancing the science of endocrine mediated toxicity. The European Commission and the World Health Organization (WHO), through the International Program for Chemical Safety have issued a report titled “[Global State-of-the-Science of Endocrine Disruptors](#).” This report concluded: “Although it is clear that certain environmental

chemicals can interfere with normal hormonal processes, there is weak evidence that human health has been adversely affected by exposure to endocrine-active chemicals. However, there is sufficient evidence to conclude that adverse endocrine-mediated effects have occurred in some wildlife species.” In 2003, the Ministry of Environment of Japan and the WHO International Program on Chemical Safety hosted a joint workshop and report entitled “[Endocrine Disruptors: Research Needs and Future Directions.](#)” Both the European Commission and the WHO are supporting efforts at the Organization for Economic Co-operation and Development (OECD) to develop test methods to evaluate endocrine active compounds. Furthermore, the European Commission and EPA have agreed to share information on priority setting, screening, and testing as well as research activities.