ENDOCRINE DISRUPTION

Endocrine hormones act as control agents that regulate homeostasis, development, and many other bodily functions in humans and other animals. They are secreted directly into the blood by the endocrine glands (pineal, hypothalamus, pituitary, thyroid, parathyroids, thymus, adrenals, pancreas, and ovaries or testes). The disruption of endocrine function by chemicals, both natural and synthetic, in wildlife, experimental systems and humans is an area of toxicology that has received focused international attention since 1991.

Endocrine disruption is the alteration of endocrine function that results in adverse health effects in an intact organism, or its progeny, or (sub) populations [World Health Organization, 2002]. Endocrine hormones naturally act at low concentrations, and certain chemicals are suspected of altering endocrine function at similarly low concentrations, which sometimes occur in the environment. A large and growing body of environmental health literature suggests that endocrine-disrupting substances may not follow standard dose-response curves following the central tenet of regulatory toxicology, but may have what endocrinologists call bi-phasic dose response curves. It is not always certain whether responses observed at very low doses would be predictable based on responses observed at higher doses, whether they follow the same mechanism of action or would result in an adverse event either within the organism or more broadly within the population. Consequently, this issue is currently the subject of intense investigation. [see Endocrine Society 2015]

Further Considerations

- Research areas for continued improvements in testing for endocrine disruption are focusing on:
- well-designed in vitro and in vivo laboratory studies, ecological studies and human epidemiological investigations;
- mechanisms of action with emphasis on understanding biphasic dose-response behaviors and specifically on adverse effects that occur in humans, aquatic species and wildlife at low doses that are not detected under normal toxicology testing paradigms;
- improvement of early identification of endocrine active chemicals and chemical classes;
- identification of exposure pathways, uptake mechanisms, and trends in human, aquatic and wildlife exposures and impacts;
- laboratory experiments conducted at physiologically- and environmentally-relevant dose levels;
- improvement of tools, including a broad range of in vivo, in vitro, and in silico assays that can serve as screening tests to potentially model endocrine disrupting activity and empower decision makers;
- expansion of education regarding endocrine disruption to improve the understanding of the public, policy makers and the scientific community; and
- applying the learnings from this research to the implementation of the Endocrine Disruptor Screening Program (EDSP). The EDSP requires updates to both the test protocols and the protocols by which federal agencies determine the legitimacy of scientific data.

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Adopted, March 2017