TESTING FOR ENDOCRINE DISRUPTION

Endocrine hormones act as control agents that regulate homeostasis, development, and many other bodily functions. 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 both experimental systems and humans is an area of toxicology that has received focused international attention since 1991 and is highly relevant to the American Chemical Society (ACS).

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, or non-monotonic, 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.

Recommendations

The Society strongly endorses expanded endocrine disruptor education and research and the development of more effective science-based, decision-making tools and methods for reducing and eliminating exposures to endocrine disrupting chemicals posing risk to humans and the environment. Specifically, ACS encourages expansion of funding for the following:

- Continued improvements in testing for endocrine disruption with emphasis on development/refinement of predictive
    - well designed in vitro and in vivo laboratory studies and human epidemiological investigations;
    - mechanisms of action with emphasis on understanding non-monotonic dose-response behaviors and specifically on adverse effects that occur 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 exposures and impacts.
- A more strategic progression of the science related to endocrine disruption testing, and the application of the learnings to Endocrine Disruptor Screening Program (EDSP) implementation is needed, including updating of both the test protocols and the protocols by which federal

The American Chemical Society (ACS) Board of Directors Committee on Public Affairs and Public Relations adopted this statement on behalf of the Society at the recommendation of the Committees on Environmental Improvement and Corporation Associates. ACS is a non-profit scientific and educational organization, chartered by Congress, with more than 158,000 chemical scientists and engineers as members. The world's largest scientific society, ACS advances the chemical enterprise, increases public awareness of chemistry, and brings its expertise to state and national matters.

agencies determine the legitimacy of scientific data related to non-monotonic dose-response behavior, with 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.
- Green chemistry education and research aimed at identifying and developing functional alternatives.