

US EPA Mid-Continent Ecology Division

Research Project Summary

A Systems Approach to Using Small Fish Models for Assessing Developmental and Reproductive Toxicity

Overview

A 21-day fathead minnow reproduction assay has been developed as a basis for identifying endocrine function-disrupting chemicals. Mechanism-specific endpoints diagnostic of alterations in endocrine function (e.g., induction of vitellogenin, alterations in sex steroid concentrations, changes in secondary sex characteristics) and data relevant to assessing recruitment (fecundity, fertility, hatch, early development) are collected in a fraction of the time and cost required for full life-cycle tests. Data are far less variable (statistically more powerful) than what is possible to collect from most full life-cycle test designs. Hence, although the test was developed initially to deal with specific classes of endocrine-disrupting chemicals, the basic test (and its underlying premises) should be valuable for other risk assessment scenarios. Plans are to optimize the 21-day fathead minnow assay for both prospective and retrospective assessments. For example, we are using a variety of "omics" tools to develop gene, protein, and metabolic endpoints diagnostic of exposure to/effects of different classes of chemicals. We will use the test to generate data for chemicals, such as pesticides and/or high production volume materials, which are commonly subjected to higher-tier, prospective risk assessments via EPA regulatory programs. Toxicity data will then be integrated with biological systems and demographic population models developed for the fathead minnow to make predictions of biological impacts.

These approaches will allow linkages to be made between molecular diagnostic endpoints and adverse responses at higher biological levels of organization. Aspects of this effort are being supported by ORD's newly-formed National Center for Computational Toxicology, and the work is being conducted with multiple EPA and non-EPA employees.

Key Products

Ankley, GT, KM Jensen, EA Makynen, MD Kahl, JJ Korte, MW Hornung, TR Henry, JS Denny, RL Leino, VS Wilson, MC Cardon, PC Hartig, and LE Gray. 2003. Effects of the androgenic growth promoter 17-B-trenbolone on fecundity and reproductive endocrinology of the fathead minnow (*Pimephales promelas*). *Environ Toxicol Chem* 22: 1350-1360.

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<http://www.epa.gov/endocrine/index.html>

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