WEC (Western Enviromics Consortium)

From Biomolecules to Behaviour: Redefining aquatic environmental health and wastewater quality standards

Municipal wastewater effluents introduce a variety of pharmaceuticals and personal care products into the aquatic environment. These chemicals have the potential to perturb diverse biological processes by disrupting hormone function yet secondary & tertiary treatments are not specifically designed to remove these endocrine disrupting compounds (EDCs). Moreover, effective environmentally- and ecologically-relevant methods for detecting EDC activity are lacking, particularly for thyroid hormone (TH)-disrupting activities. THs are essential for normal growth, behaviour, development, and metabolism in all vertebrates. One of the most striking examples of TH action is their absolute requirement for triggering frog tadpole metamorphosis into a froglet. In Ranid species, which represent the most populous of the frog families, the tadpole transitions from an aquatic to a terrestrial lifestyle in a manner possessing considerable parallels to perinatal human development. The proposed project combines the expertise of academic and government scientists to establish standardized assays based upon a native amphibian sentinel species, *Rana catesbeiana*, and quantitative real time polymerase chain reaction (qPCR) to identify TH-disrupting activities anchored to behavioural outcomes. The proposed project will discover gene transcripts that are the most sensitive and robust indicators of TH action in the bullfrog tadpole liver and olfactory epithelium using RNA-seq and link these to changes neurological function as measured by olfactory cue responses in choice maze and electro-olfactory assessments. This information will guide the development of qPCR arrays to evaluate the efficacy of removal of TH-disrupting activity in effluents produced by state-of-the-art and emerging municipal wastewater treatment technologies. The results of this work will 1) form the foundation of biologically-anchored, user-friendly assays for assessing hormone-active substances, 2) provide crucial information regarding the efficacy of EDC removal to influence future design and engineering of treatment plants, and 3) guide regulators on the incorporation of gene expression endpoints as part of water quality guidelines.

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The WEC Team

Fiona Brinkman, Simon Fraser University
Eric Hall, University of British Columbia
Caren Helbing, University of Victoria
Mary Lesperance, University of Victoria
Wayne Parker, University of Waterloo
Greg Pyle, University of Lethbridge
Graham van Aggelen, Environment Canada

For more information, contact:

Caren Helbing, Ph.D.
Professor, Biochemistry and Microbiology
PO Box 1700 Stn CSC
University of Victoria
Victoria, British Columbia V8W 2Y2
Phone: 250-721-6146
E-mail: chelbing@uvic.ca