Assessing impacts of human pollutants on aquatic life

Project team
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Timeframe
2014 - ongoing

Project description
Human activities introduce vast assortments of chemical pollutants into aquatic receiving environments at low but often biologically relevant concentrations. Reliable and comprehensive toxicity data is critical for ensuring that wildlife and ecosystem health are adequately protected. Our group applies a range of cutting edge tools and technologies to understand how pollutants influence various aquatic vertebrate and invertebrate species.

Using an Adverse Outcome Pathway approach to toxicity evaluation, our research spans understanding lower level cellular and molecular initiating events (i.e., metabolomics, proteomics and receptor activity) all the way through to higher-level effects on growth and development, morphology, reproduction and fundamental behaviours. Other areas of interests include understanding chemical uptake and tissue distributions, and how this relates to toxicity.

A major focus of the research is developing and optimising experimental techniques for applying behavioural analysis and untargeted omics towards ecotoxicology research and environmental monitoring.

Outcomes
We recently established a novel technique for ongoing measurement of circadian rhythms in fish. This represents a unique tool for exploring effects of neurotoxic compounds and pharmaceuticals such as antidepressants on fish, and may help link sub-lethal biochemical effects (e.g., altered neurotransmitter levels) to behavioural outcomes. This is important since behaviours are fundamentally linked with major ecological processes like feeding, mating and predator avoidance.

We have established a robust and transferable experimental workflow for applying untargeted metabolomics profiling to ecotoxicology testing. The method has been published (Melvin et al., 2017_Aquatic Toxicology) and more recently applied and validated with a range of aquatic species, including tadpoles, fish, copepods, jellyfish polyps, and plants.
Funding

Current funding has largely been provided through a Griffith University Postdoctoral Fellowship and New Researcher Grant to Melvin. Key behavioural equipment purchased from prior Ian Potter Foundation Science Grant. Funding from the Australian Institute for Nuclear Science and Engineering (AINSE) facilitated preliminary work exploring chemical uptake kinetics in larval amphibians. We are currently seeking funding from the Australian Research Council (Discovery scheme).

Partners

- Institute for Environment, Brunel University London, UK (John Sumpter)
- School of Environment, Griffith University (Anthony Carroll)
- Australian Nuclear Science and Technology Organisation (Tom Cresswell)
- Cawthron Institute, New Zealand (Louis Tremblay)
- Leiden University, The Netherlands (Thijs Bosker)

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Publications


Scott PD, Coleman HM, Colville A, Lim R, Matthews B, McDonald JA, Miranda A, Neale PA, Nugegoda D, Tremblay LA and Leusch FDL. 2017. Assessing the potential for trace organic contaminants commonly found in Australian rivers to induce vitellogenin in the native rainbowfish (Melanotaenia fluviatilis) and the introduced mosquitofish (Gambusia holbrooki). Aquatic Toxicology 185: 105-120

Brockmeier EK, Scott PD, Denslow ND and Leusch FDL. 2016. Transcriptomic and physiological changes in Eastern Mosquitofish (Gambusia holbrooki) after exposure to progestins and anti-progestagens. Aquatic Toxicology 179: 8-17

Melvin SD, Lanctôt CM, van de Merwe JP, and FDL Leusch. 2016. Altered bioenergetics and developmental effects in striped marsh frog (Limnodynastes peronii) tadpoles exposed to UV treated sewage. Aquatic Toxicology 175: 30-38.


