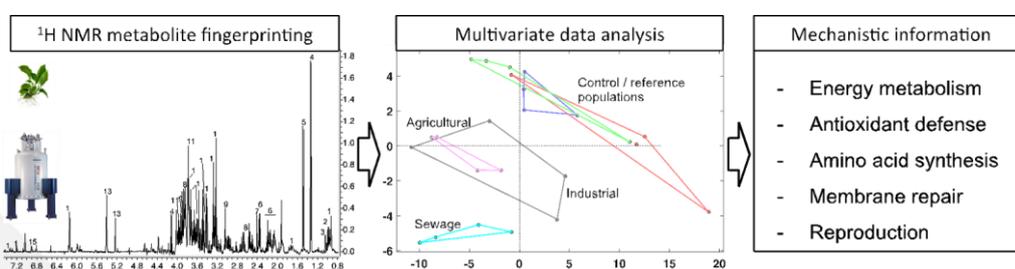


Assessing impacts of human pollutants on aquatic life



Project team

Steven Melvin, Frederic Leusch, Jason van de Merwe, Chantal Lanctôt

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)

For more information, contact

Dr Steven Melvin

Email: s.melvin@griffith.edu.au

Publications

Lancôt CL, Cresswell T, and SD Melvin. 2017 Uptake and tissue distributions of cadmium, selenium and zinc in striped marsh frog tadpoles exposed during early post-embryonic development. *Ecotoxicology and Environmental Safety* 144: 291-299.

Bosker T, Santoro G, and SD Melvin. 2017. Salinity and sensitivity to endocrine disrupting chemicals: A comparison of reproductive endpoints in small-bodied fish exposed under different salinities. *Chemosphere* 183: 186-196.

Lancôt CL, Cresswell T, Callaghan PD, and SD Melvin. 2017. Bioaccumulation and biodistribution of selenium in metamorphosing tadpoles. *Environmental Science and Technology* 51:5764-5773.

Melvin SD, Petit MA, Duviol MC, and JP Sumpter. 2017. Towards improved behavioural testing in aquatic toxicology: Acclimation and observation times are important factors when designing behavioural tests with fish. *Chemosphere* 180: 430-436.

Lancôt CL, Melvin SD, and T Cresswell. 2017. Selenium speciation influences bioaccumulation and tissue distribution in *Limnodynastes peronii* tadpoles exposed during larval development. *Aquatic Toxicology* 187: 1-8.

Melvin SD, Habener LJ, Leusch FDL, and AR Carroll. 2017. ¹H NMR-based metabolomics reveals sub-lethal toxicity of a mixture of diabetic and lipid-regulating pharmaceuticals on amphibian larvae. *Aquatic Toxicology* 184: 123-132.

Melvin SD. 2017. Effect of antidepressants on circadian rhythms in fish: insights and implications regarding the design of behavioural toxicity tests. *Aquatic Toxicology* 182: 20-30.

Scott PD, Coleman HM, Colville A, Lim R, Matthews B, McDonald JA, Miranda A, Neale PA, Nuggeoda 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, Lancôt 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.

Melvin SD, Buck DR, and LD Fabbro. 2016. Diurnal activity patterns as a sensitive behavioural outcome in fish: Effect of short-term exposure to treated sewage and a sub-lethal PPCP mixture. *Journal of Applied Toxicology* 36: 1173-1182.

Melvin SD. 2016. Oxidative stress, energy storage, and swimming performance of *Limnodynastes peronii* tadpoles exposed to a sub-lethal pharmaceutical mixture throughout development. *Chemosphere* 150: 790-797.

Lancôt C, Bennett W, Wilson S, Fabbro L, Leusch FDL, and SD Melvin. 2016. Behaviour, development and metal accumulation in striped marsh frog tadpoles (*Limnodynastes peronii*) exposed to coal mine wastewater. *Aquatic Toxicology* 173: 218-227.

Melvin SD, Cameron MC, and CM Lancôt. 2014. Individual and mixture toxicity of the pharmaceuticals naproxen, carbamazepine and sulfamethoxazole to Australian striped-marsh frog tadpoles (*Limnodynastes peronii*). *Journal of Toxicology and Environmental Health, Part A*. 77: 337-345.

Leusch FDL, Khan SJ, Gagnon MM, Quayle P, Trinh T, Coleman H, Rawson C, Chapman HF, Blair P, Nice H and Reitsem T. 2014. Assessment of wastewater and recycled water quality: A comparison of lines of evidence from *in vitro*, *in vivo* and chemical analyses. *Water Research* 50: 420-431