USING MOLECULAR METHODS TO IMPROVE METAL MIXTURE RISK ASSESSMENT AT MINING-IMPACTED SITES

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Environmental contamination by mining activity is a global problem, and toxic metal pollution can affect human and environmental health. Regulation of metal-impacted freshwaters can be informed by using bioavailability-based geochemical speciation models such as the Biotic Ligand Model (BLM). These models are used to calculate the binding of metals to exposed organisms by modeling the biogeochemical mechanics of metal uptake to the site of toxic action (the biotic ligand), as affected by complexation of metals by abiotic ligands in the water (e.g., dissolved organic matter) and by metal-metal competition for binding to biotic ligands. Thus far, application of geochemical speciation models to metal mixture toxicity has assumed additive behavior. However, metal mixtures do not always exhibit additive toxicity, thus sometimes leading to inaccurate prediction of toxicity in mining-impacted freshwater environments. The overarching goal of this work is the development of tools that can more accurately assess freshwater sites impacted by mining activities. Our previous work indicates a protective effect of zinc against cadmium toxicity, because *Daphnia magna* exposed to cadmium in the presence of zinc exhibited increased survival compared to *Daphnia* exposed to cadmium alone. Results of RNAseq genomic analysis indicate that competitive binding at the biotic ligand does not fully explain the lower toxicity of cadmium in the presence of zinc. To further evaluate the underlying mechanisms of cadmium-zinc toxicity, we measured the internal dose of cadmium and zinc in *Daphnia* after 48 h using ICPMS and determined cadmium-zinc toxicity to *Daphnia* across a wider range of time points and concentrations. Additional RNAseq analysis at targeted cadmium-zinc concentrations could further elucidate the protective mechanisms of zinc in the presence of cadmium. The regulation of metal mixtures depends on accurate risk assessments, and results of this work can be used to inform the management of aqueous discharges from mining-related activities.

PRESENTER BIO: I am a 3rd year PhD student in the department of Environmental and Global Health at the University of Florida. I have 4 years of environmental toxicology technician experience prior to starting my doctorate. I am interested in the effects of metal mixtures on gene expression and how these high throughput technologies can inform regulatory decisions.