



**Environmental Science Seminar**  
**School of Public and Environmental Affairs**  
**Room 278, Thursday, January 19<sup>th</sup> at 4:00pm**

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**Duplicating Genes Allow *Daphnia* Populations to Thrive in Toxic Environments**

**Abstract:**

*Daphnia*, or the water flea, is a sentinel species of freshwater ecosystems. Their populations are defined by the boundaries of ponds and lakes, are sensitive to modern toxicants in the environment, and thus are used to assess the ecological impact of environmental change. Their short generation time, large brood sizes, and ease of laboratory and field manipulation have assured *Daphnia*'s importance for setting regulatory standards by environmental protection agencies, for testing chemical safety, for monitoring water quality, and as a model for environmental genomics research. A hallmark of the genome sequence is a large number of duplicated genes that are most responsive to ecological challenges and are specific to the *Daphnia* lineage. In this study, we take advantage of maturing genomics tools to understand the molecular basis for evolved tolerance to toxic levels of certain metals. We also test the adaptive significance of *Daphnia*'s genome structure. Natural populations that have faced severe chemical challenges for over a century of industrial iron/ore smelting demonstrate evolved tolerance to cadmium. Other reference populations that have no history of chemical stress are clearly harmed by metal exposure, showing slower growth rates, lower fecundity and higher mortality. By measuring the distribution of copy number variants and interrogating differential expression of 31,000 annotated genes from sampled populations across chemical conditions, this study provides new insights into the functional interactions between genome structure and environment. This research benefits from, and contributes to, the *Daphnia* Genomics Consortium, <http://daphnia.cgb.indiana.edu>.