Systems approach to detect and evaluate contaminants of emerging concern in the Great Lakes

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The release of chemicals of emerging concern threatens near shore health in the Great Lakes, particularly in regions already suffering from degradation of water and environmental quality due to past and present anthropogenic activities. Critical issues remain in delisting Areas of Concern (AOC) including determining sources of chemicals causing fish health impacts (sediment, sewage overflow, effluent discharges, or tributary waters), relating health impacts to chemical exposure or specific source points, and identifying causes of adverse health effects. Here, we used fathead minnows (*Pimephales promelas*) caged at different locations within AOC to monitor the impacts of bioavailable chemicals on fish health as predicted/indicated by changes in reproductive, physiological and molecular endpoints. We used gene expression changes and network analysis to understand the potential effects of chemicals of emerging concern on gene expression, with the goal of being able to understand potential associations between genes and chemicals that could be used to predict and monitor chemical presence. We used network inference (CLR, context likelihood of relatedness) to infer relationships between gene expression changes in the ovary of exposed fish and chemical levels in the water. This analysis was able to infer relationships between chemicals such as naphthalene and methylnaphthalene to gene levels that have been previously related to their exposure in other organisms such as rat. These results show that a systems approach can be very valuable to infer relationships between gene expression in exposed fish and chemicals in the water. This new information could be useful in developing new strategies to delisting AOCs.