Might Two Potential Toxins Have Less Risk Than One?
Mercury and Selenium in Two Idaho Surveys

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Mercury (Hg) is a toxin that is a ubiquitous environmental contaminant because of atmospheric transport from local, regional, and global sources. However, concentrations of methylmercury (MeHg), the most hazardous form, can vary greatly in freshwaters because of environmental factors affecting methylation of inorganic mercury. Dissolved organic carbon (DOC) in water is, for example, one major factor that may enhance methylation in aquatic ecosystems. Selenium (Se), a necessary micronutrient, becomes toxic in elevated concentrations, posing another risk to aquatic ecosystems in North America, leading to ecosystem collapse in some cases. However, Se also is known to reduce the formation and bioaccumulation of MeHg. When both Hg and Se are present, they interact to reduce the bioavailability and thus the toxicity of the other, possibly via the formation of metabolically inert mercury selenides.

The Blackfoot River drainage of south-eastern Idaho is an area of predicted elevated Hg deposition and high DOC concentrations. However, monitored MeHg levels in fish tissue samples appear anomalously low. Because of this puzzle, The U.S. Geological Survey conducted a reconnaissance survey in the summer of 2010 of MeHg in the waters of the Blackfoot Reservoir. The goal of this survey was to determine if evidence exists in the ecosystem for the hypothesis that Se loading from local mining or mineralization inhibits MeHg production and bioaccumulation. The observed MeHg concentrations in water were substantially lower than national averages for streams and lakes. Therefore, this initial evaluation of MeHg levels in the Blackfoot Reservoir suggests MeHg production may be inhibited by Se loading from the watershed.

Selenium and Hg were also surveyed in fish tissues in Idaho lakes and reservoirs (50 sites) and rivers (25 sites) in 2007 and 2008. Of the 26 lake and reservoir samples with Hg above the fish-tissue criterion of 0.3 mg/kg wet weight, 13 samples had a Se to Hg molar ratio of >1. The same was true of 4 of 5 river samples. A Se to Hg molar ratio of 1has been suggested as an approximate threshold for Se to reduce Hg toxicity. Selenium and Hg fish-tissue concentrations were very weakly correlated in this survey, suggesting that environmental exposure controls observed tissue concentrations, not the intracellular interaction of Se and Hg.

While intriguing, these results are preliminary. We believe that further investigations of Se and Hg interactions could provide valuable insights.