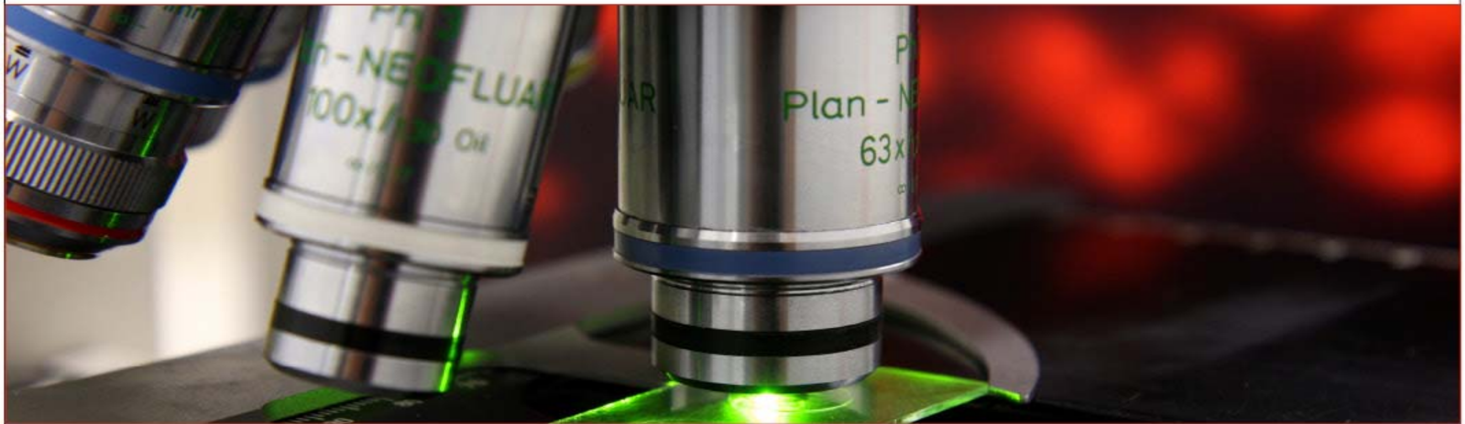
SÉMINAIRES ET CONFÉRENCES



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« The changing mercury cycle and human exposure in the eastern Canadian Arctic»

Mercury (Hg) is an element that can be affected by redox transformations which greatly influence its dispersal at the hemispheric scale. Once deposited on a northern ecosystem, Hg can be methylated into methylmercury (MeHg) by microorganisms (using the gene cluster gene cluster hgcAB) living in sediments or in biofilms. MeHg is a neurotoxicant that is easily bioaccumulated and biomagnified along aquatic northern food webs, resulting in the contamination of top predators including human communities relying on country food. With climate change, the Canadian Arctic is experiencing environmental changes that may interact with mercury cycling. In particular, northern warming may cause permafrost thawing that can lead to release of nutrients and dissolved organic carbon into ecosystems and to the creation of thaw ponds. These permafrost thaw ponds are now ubiquitous in the eastern Canadian Arctic. Our recent multi-year study on Eastern Canadian thaw ponds suggests a relationship between organic matter erosion from thawing permafrost, reducing conditions in the sediments, and the microbial production of MeHg in these sites. Greater hydrological connectivity from permafrost thawing may potentially increase transport of MeHg from thaw ponds to neighboring aquatic ecosystems.

The Canadian Arctic is also characterized by the presence of Inuit communities. The traditional Inuit diet can expose its practitioners to high levels of MeHg, making Hg a major health issue in the North. Recent studies have shown that current pharmacokinetic models aiming to predict the effects of Hg on humans are unable to properly describe the Inuit. This suggests that genetic, cultural or environmental factors may play a role in absorbing Hg. We recently identified factors that can alter Hg absorption in the Inuit of Resolute Bay (Nunavut). We showed that culinary practices from the Inuit traditional diet, identified through dietary habit questionnaires, can impact MeHg bioaccessibility from fish. Various cooking techniques including grilling, frying and boiling reduced MeHg bioaccessibility when compared to raw fish. We also tested the effects of co-ingested foods rich in phytoelements. Tea and coffee, commonly consumed with meals in our sampled cohort, reduced bioaccessibility to varying degrees. Cooking treatments and co-ingested foods had a combined effect greater than their individual impacts. Therefore, dietary practices can alter the solubility of Hg in the gut, limiting its absorption by the body.

We also investigated the role of the gut microbiome in Hg metabolism in the gut, using stool samples donated by Inuit participants. Deep sequencing of the bacterial 16S rRNA gene revealed subtle differences between the Inuit and a group of participants from temperate latitudes with a western diet; the similarity between both groups may indicate that the Inuit microbiome is transitioning towards a western style microbiome through a change in feeding habits. Through shotgun metagenomic sequencing, we further show that the Inuit microbiome possesses genes of inorganic mercury resistance (the mer operon) but not genes linked to mercury methylation (the hgcAB cluster).
Overall, our results indicate that the eastern Canadian Arctic is undergoing changes in Hg cycling that may increase animal and human exposure. However, Inuit habits may rely less on country food in the future, therefore reducing Hg exposure.

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