Methyl mercury in the Canadian Arctic: Implications to Human Health

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Introduction

The image of the Canadian Arctic being a pristine area untouched by anthropogenic contaminants is unfortunately no longer the reality. Due to global long-range transport, locations at higher altitudes and latitudes are often the site of contaminant deposition such as mercury (Hg)[1]. Methyl mercury (MeHg) is the most toxic form of Hg as it a potent neurotoxin and rapidly bioaccumulates[2]. The traditional diet of the Inuit includes many high trophic level species, thus increasing their potential MeHg exposure. Despite the benefits of this diet, which is rich in nutrients and a valuable source of cultural identity, the risks to vulnerable subpopulations such as pregnant women and infants need to be carefully assessed.

MeHg and Development

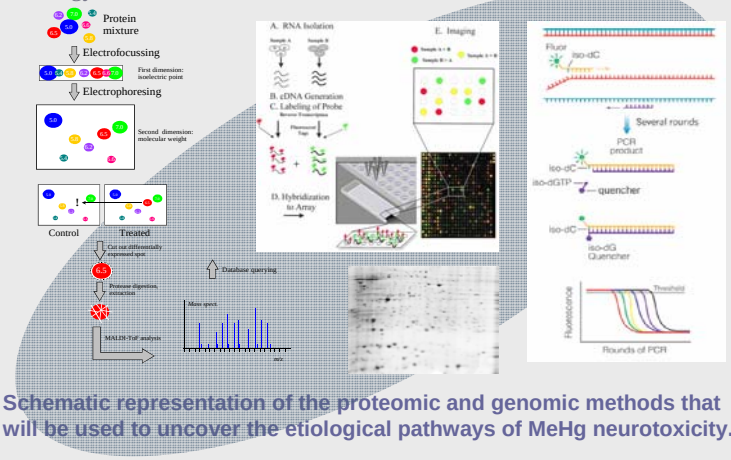
Unlike the mature brain, the fetal and neonate brain undergoes tremendous growth and restructuring requiring the regulations of a complexity of molecular pathways. Historical cases of MeHg poisoning, such as Minamata Japan, have demonstrated that children exposed *in utero* to MeHg suffer from life-long symptoms including; mental retardation, memory disability, attention deficits, hearing and vision loss, and deformities, while the mothers were generally left unaffected[2]. Epidemiological studies were corroborated by laboratory studies using animal models and cell cultures. In addition to neurotoxicity[3], MeHg also causes and array of health problems, ranging from cardiovascular toxicity[4] to immunotoxicity[5]. The molecular mechanisms underlying the etiology of MeHg toxicity are not entirely understood but may include oxidative stress[6].

Research Objectives

• To assess the MeHg exposure via a traditional food diet to the Inuit in Nunavut. We will team up with the Nunavut Research Institute (NRI) and the Niqiit Avatittinni Committee (NAC) to take samples for MeHg analysis.

• Using an animal model, we will explore the biological consequences of MeHg exposure to a developing fetus using various molecular tools.

The traditional diet is still widely used in Nunavut communities, providing an important source of nutrition and cultural identity.



Schematic representation of the proteomic and genomic methods that will be used to uncover the etiological pathways of MeHg neurotoxicity.

Research Outline

1. Rat pups will be exposed *in utero* and lactationally to MeHg alone and in combination with various nutrients that may mitigate MeHg toxicity.
2. Several endpoints will be monitored, including pups growth, behaviour and survival.
3. At post-natal day 14 they will be sacrificed and blood, brain and liver samples will be collected to assess total and MeHg, and cellular oxidative stress levels.
4. We will also monitor brain protein pattern by two-dimensional gel electrophoresis and MALDI-ToF protease fingerprinting. Brain gene expression will be assessed by microarray hybridisation and verified with Real-Time PCR.
5. Using statistical analysis we will compare data from the treatment groups to the controls and the efficacy of the dietary supplementation will be assessed.
6. Results obtained will be brought to Arctic communities during community rounds with the NAC in a culturally friendly manner.

References

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