**Genetic Origins of Mercury Resistance in Great Salt Lake Microorganisms**

Ashtyn Smith, Austin Wood, Chelsea Lam, Jaimi Butler, Bonnie Baxter
Westminster College, 1840 S 1300 E, Salt Lake City, UT, 84105

**Introduction**

Extremophiles are a diverse group of organisms, typically Bacteria and Archaea, that can inhabit extreme environments, such as geysers, deserts, and saline lakes. Their abilities to withstand extremely dry, hot, saline, acidic, and mercuric conditions have made these microorganisms admirable astrobiological models for life on other planets.1

**Background**

Methylmercury (CH$_3$Hg) is a neurotoxin that accumulates in aquatic environments due to the actions of microorganisms, which can produce this biologically relevant organic form from elemental mercury (Hg) (Figure 1, right). Many species of microorganisms have shown resistance to Hg and can thrive in polluted waters. Recent studies have shown that Hg resistance in Bacteria and Archaea arises from one of two gene pairs, mercury (Hg) or mercury (Hg) (Figure 1, right). The merAB system produces gene products that allow the organism to convert CH$_3$Hg into elemental Hg$_2$. Conversely, the hgcAB system converts Hg into CH$_3$Hg$_2$(Table 1). Through these mechanisms, microorganisms can play a significant role manipulating the health of aquatic ecosystems.

**Materials & Methods**

Overview: Microorganisms will be harvested from the GSL and cultivated on increasing concentrations of mercury. The most resistant microbes will undergo genetic analysis to identify resistant genotypes in the population.

**Hypothesis**

GSL microorganisms that demonstrate a robust resistance to mercury will express either the hgcAB or merAB genotype.

**Objectives**

1. Identify mercury-resistant microorganisms in the GSL.
2. Establish the range of mercury resistance.
3. Determine the mercury-resistant genotype.

**Harvest, Cultivation, & Isolation**

Anaerobic halophiles, “salt-loving” microorganisms, were obtained from the deep brine layer of the GSL. This method was repeated in 8 different locations of the lake in order to observe a broader sample of the GSL microbial community. Locations are listed in Tables 2, 3, & 4. Samples were cultivated in broth culture before being transferred to anaerobic chambers.

**Determining Mercury Resistance**

Individual colonies were selected from the 5 ppm Hg(II)Cl$_2$ plates and transferred to 10 ppm Hg(II)Cl$_2$ plates with corresponding salinities. After sufficient colony growth was observed, the specimens were transferred to 20 ppm Hg(II)Cl$_2$. In this way, mercury concentrations were slowly increased in order isolate the most resistant microorganisms. All plates were incubated at 37°C in anaerobic chambers.

**Results**

Mercury-resistant halophilic species have successfully been cultivated on 5, 10, and 20 ppm Hg(II)Cl$_2$ plates across various salinities, distributions represented Tables 2, 3, & 4. Of the eight sampling sites, 46, 26, and 25 distinct colonies were exhibited on 5, 10, and 20 ppm Hg(II)Cl$_2$ plates, respectively.

**Conclusions**

GSL microorganisms demonstrate a robust resistance to mercury chloride, as was shown in Tables 2, 3, and 4. The mercury-resistant genotype of these halophiles, however, were not identified. Initial analysis of four 20 ppm Hg(II)Cl$_2$ isolates suggests that two microbes express the hgcAB genotype while two others seem to demonstrate both hgc and mer genotypes (Figures 2 & 3). Despite these results, genetic sequencing was not conclusive. More experiments will be needed before extending any conclusions.

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**References**

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