



Review

# Genetic Aspects of Susceptibility to Mercury Toxicity: An Overview

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Academic Editor: Paul B. Tchounwou

Received: 3 November 2016; Accepted: 12 January 2017; Published: 18 January 2017

**Abstract:** Human exposure to mercury is still a major public health concern. In this context, children have a higher susceptibility to adverse neurological mercury effects, compared to adults with similar exposures. Moreover, there exists a marked variability of personal response to detrimental mercury action, in particular among population groups with significant mercury exposure. New scientific evidence on genetic backgrounds has raised the issue of whether candidate susceptibility genes can make certain individuals more or less vulnerable to mercury toxicity. In this review, the aim is to evaluate a new genetic dimension and its involvement in mercury risk assessment, focusing on the important role played by relevant polymorphisms, located in attractive gene targets for mercury toxicity. Existing original articles on epidemiologic research which report a direct link between the genetic basis of personal vulnerability and different mercury repercussions on human health will be reviewed. Based on this evidence, a careful evaluation of the significant markers of susceptibility will be suggested, in order to obtain a powerful positive “feedback” to improve the quality of life. Large consortia of studies with clear phenotypic assessments will help clarify the “window of susceptibility” in the human health risks due to mercury exposure.

**Keywords:** mercury; toxicokinetics; human health; risk assessment; children exposure; environmental genetics; DNA variants; biomarkers of susceptibility

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## 1. Introduction

Mercury (Hg) is a global pollutant and well-known neurotoxin that has raised great fear in the international scientific community, due to a variety of significant and documented adverse effects on human health and the environment throughout the world [1]. Despite being a well-documented systemic toxicant, an understanding of all the molecular mechanisms underlying the damage induced by Hg is still elusive.

The need to further reduce Hg emissions, as well as to develop preventive strategies in relation to Hg risk assessment and management makes the situation even more challenging, especially for those individuals most susceptible to the effects of Hg exposure, such as children and adolescents [1]. The two categories are highly sensitive to the neurotoxic Hg effects, displaying extreme variability in mainly neurological and neurobehavioural outcomes throughout subsequent life stages [2].

The pathological impact of Hg on humans and other organisms is widely proven, and the overall picture is quite complex. Human exposure may occur chronically through a variety of pathways in the world population, including industrial processes, occupational and household uses, dental amalgams, Hg-containing vaccines, consumption of contaminated fish and marine mammals, and many others [2]. To date, two main types of risk for human health have been detected: a direct one, related to the inhalation of gaseous Hg, with several pathophysiological impacts, and collateral risks, related to differences between Hg species.