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Chronic Metals Ingestion By Prairie Voles Produces Sex-Specific Deficits In Social Behavior: An Animal Model Of Autism

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Abstract

We examined the effects of chronic metals ingestion on social behavior in the normally highly social prairie vole to test the hypothesis that metals may interact with central dopamine systems to produce the social withdrawal characteristic of autism. Relative to water-treated controls, ten weeks of chronic ingestion of either Hg⁺⁺ or Cd⁺⁺ via drinking water significantly reduced social contact by male voles when they were given a choice between isolation or contact with an unfamiliar same-sex conspecific. The effects of metals ingestion were specific to males: no effects of metals exposure were seen in females. Metals ingestion did not alter behavior of males allowed to choose between isolation or their familiar cagemates, rather than strangers. We also examined the possibility that metals ingestion affects central dopamine functioning by testing the voles' locomotor responses to peripheral administration of amphetamine. As with the social behavior, we found a sex-specific effect of metals on amphetamine responses. Males that consumed Hg⁺⁺ did not increase their locomotor activity in response to amphetamine, whereas similarly-treated females and males that ingested only water significantly increased their locomotor activities. Thus, an ecologically relevant stimulus, metals ingestion, produced two of the hallmark characteristics of autism – social avoidance and a male-oriented bias. These results suggest that metals exposure may contribute to the development of autism, possibly by interacting with central dopamine function, and support the use of prairie voles as a model organism in which to study autism.

Keywords

microtus; autism; dopamine; toxicology; metal; mercury; social behavior; prairie vole

Introduction

The autism spectrum disorders are widespread in the developed world and the incidence of autism may be increasing. It is clear from several decades of study that autism is a complex (of) disorder(s) involving both genetic and environmental factors, but there is far from

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