Effects of Copper Sulfate Exposure on the Nervous System of the Hirudo verbana Leech

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Electronic waste is the world's fastest-growing waste stream, and a source of contamination as the heavy metals used in electronics leach into the environment. Because of its electrical and thermal conductivity, copper is used extensively in electronics production, and is therefore a potential environmental pollutant with degradation of electronics in landfills. Copper is also an essential micronutrient for life, a cofactor for many enzymes. However, excess exposure to this heavy metal can lead to adverse physiologic effects. This study focused on toxic effects of copper sulfate on the nervous system of the Hirudo verbana leech, hypothesizing that copper exposure leads to neurobehavioral changes, alterations with light microscopy analysis of nerve ganglia, and proteomic changes within nerve ganglia. Leeches were exposed to copper sulfate-distilled water solutions of 0 to 5 parts per million for 96 hours. Neurobehavioral testing was done to assess motility as well as the length of time leeches ingested liver samples. Nerve cords and ganglia were dissected out for light microscopy examination and proteomics testing. With copper exposure, food avoidance, diminished dark-seeking behavior, and decreased motility were observed. Histopathologic damage and proteomic alterations were additionally found within nerve ganglia of copper-exposed leeches. These findings contribute to our understanding of potential mechanisms for nervous system damage with copper exposure. The results are of grave concern as they indicate that copper accumulation in the environment has tangible neurological consequences for exposed organisms. It is vital that electronic waste is handled properly to avoid contamination of soil and water sources with heavy metals such as copper.

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