
The Toxicity of Metals

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Any metal capable of disrupting essential physiological processes is considered toxic. Examples of this are cadmium, lead and mercury. Other metals in the wrong form can be toxic. For example, chromium as the Cr+3 ion is an essential trace element important for maintaining correct blood sugar levels, but as the Cr+6 ion, it is a known human lung carcinogen.

The toxic effects of most metals can be traced to their ability to disrupt the function of essential biological molecules; such as proteins, enzymes and DNA. In some cases this involves displacing chemically related metal ions that are required for important biological functions; such as cell growth, division and repair. We have to acknowledge that our present knowledge regarding metal toxicity is much greater than a century ago, but will be regarded insufficient decades from now.

Proteins, in particular, play an astounding number and variety of roles in living organisms. They are used as structural elements, for sending signals both within and between cells, and as enzymes for the synthesis and degradation of other biological molecules. If a metal ion binds to the amino acids of a protein, the resulting metal-protein complex may lack the protein's original biological activity.

One metal may also substitute for another similar metal. For example, the toxic metal, cadmium, can substitute for the essential metal, zinc, in certain proteins that require zinc for their structure or function. This can lead to alterations in that protein that can have toxic consequences. In the same way, lead can substitute for calcium in bone, and in other sites where calcium is required.

Metal ions can also remove an electron from the amino

acids of a protein in a redox reaction that disrupts its ability to carry out its biological function. Metal ions can also remove an electron from the bases of DNA. Such oxidative damage to these biological molecules is implicated in the cumulative effects associated with aging and in the mutations associated with cancer.¹

Are heavy metals the same as toxic metals?

In short, the answer is no, as "heavy" refers to the atomic weight of an element, not its tendency to behave as a biological bully. While the heavy metals cadmium, lead and mercury are toxic, molybdenum is a heavy but essential metal, while beryllium is a light but very toxic metal.

Heavy metals have always been present in the earth's ecosystem, but since the Industrial Revolution there has been a massive redistribution of metals on the surface of the earth. What has changed, is the relative availability and the forms in which metals are being dispersed.

The problem with certain heavy metals is that they tend to form very stable and long-lasting complexes with sulphur in biological molecules, which can disrupt their biological function. In some cases this allows these metals to become concentrated at higher levels of the food chain.¹

Metals in Environmental Medicine

While some European countries enforce strict regulations, the Asian countries, by comparison, are more relaxed about enforcing international standards. Overall, the World Health Organization (WHO) tries to oversee that regulations are followed and holds workshops in various parts of the world, regarding environmental health. Several heavy metals have become of concern to countries, such as India, where arsenic in water has affected the health of large number of people. Cadmium in rice has been a concern, or mercury in fish near



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