

"Heavy Metal"—Cacophony, Not Symphony

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DEAR SIR:

I thank Dr. Graeme Batley for his comments because they allow me to expand on my continuing objections to the use of the term "heavy metals." There are good reasons why everyone, including Graeme, should stop using this undefined, incorrect, and misleading term.

Just because a term is well-accepted does not mean we should not question it and, if necessary, stop using it. Failure to do so is a "scientific sin of omission" (Chapman 2012). Graeme, you have not sinned—yet—because you are still questioning. Go forth redeemed after saying 10 times "heavy metal is music not science" (Chapman 2007).

The term "heavy metal" is too imprecise for scientific use—it means different things to different people. For instance, a Google search of the term "heavy metal" provides a wide variety of definitions including: metals that can be precipitated by hydrogen sulfide in acid solution (e.g., Pb, Ag, Au, Hg, Bi, Cu), a metal of atomic weight greater than Na (22.9) that forms soaps on reaction with fatty acids (e.g., Al, Pb, Co), a metal whose specific gravity is approximately 5.0 or higher, and cacophonous, atonal, near-random, discordant, morally degenerate noise made by increasingly aged unkempt freaks of indeterminate gender electronically amplified to decibel levels at which a permanent hearing-damage advisory warning ought to be in effect.

Graeme, you yourself stated "A Google search reveals a number of attempts to define heavy metal from a chemical perspective, based on density, atomic weight or atomic number, which were inexact and variable in their application." We agree that the term is imprecise and ill defined. Let's also agree to get rid of it.

As I note above, the term has not, despite your protestation otherwise, "adequately discriminated between the metals of environmental concern..." Rather, it has caused confusion, particularly among lay people, who think heavy metals are truly (see Hodson 2004) "geochemical bogey men" and always toxic. Given that the dose makes the poison, all metals, metalloids, and nonmetals are of potential environ-

mental concern and focusing on heavy metals, defined however one wants, can cause us to ignore other inorganic contaminants that may be of greater concern. For instance, "sodium, potassium, calcium, and magnesium, which are all major ion constituents of natural waters" also comprise total dissolved solids, which are of great concern in many parts of the world where increasing salinity and conductivity is adversely affecting freshwater biota.

I am not the only one who has objected to the term heavy metals (Nieboer and Richardson 1980; Conrad 1999; Duffus 2002; Hodson 2004), although I may be the most persistent. However, Graeme, it may surprise you that I could agree with you to keep the term "heavy metals." However, I could only do so on 2 conditions: first that there is agreement on a common definition, and second, that everyone uses the term as defined. Unfortunately, I do not believe that will ever happen; I suspect you probably would agree.

Graeme, it is "broke" and we do need to "fix it." As Hodson (2004) stated in his 2-sentence conclusion, "Heavy metals is a poor scientific term and alternatives exist. As scientists we should use them." Amen.

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