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EDITORIAL

Highlight report: redox—metals in toxicology

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Recently, Valko et al. (2015) from Bratislava contributed a comprehensive review on the role of redox and non-redox metals in human disease. A typical feature of some metals, such as copper and iron, is that at low concentrations they are essential for health; whereas, at higher concentrations they can be toxic (Finazzi and Arosio 2014; Dusek et al. 2015; Gaetke et al. 2014). For example, superoxide radical anions formation followed by the generation of hydroxyl radicals has been reported for both copper and iron at high concentrations (Valko et al. 2015). A further mechanism that contributes to the toxicity of some metals involves their ability to compete with other metals that have essential functions in mammalian cells. Cadmium, for instance, acts as a substitute for copper and zinc, thus describing a key molecular mechanism of cadmium-induced hepatotoxicity (Valko et al. 2015). Finally, the interference of iron and manganese by lead causes a disruption in oxygen and energy consumption during the fetal stage in humans (Kopp et al. 2012). The current review article of Valko and colleagues systematically discusses the biochemistry of metal-induced radicals derived from oxygen and nitrogen and finally focusses on the toxic mechanisms of iron, copper, arsenic, cadmium, and zinc, as well as their role in human disease.

Control mechanisms underlying oxidative stress still remain a topic at the forefront of toxicological research, such as the decoding of different signaling pathways involved in oxidative damage (Toledo et al. 2014; Brobey et al. 2015; Liu et al. 2005; Marashi et al. 2008) or antioxidant defense mechanisms (Lim et al. 2014; Tangkosakul et al. 2009). In particular, research on oxidative stress induced by nanosized materials has become more and more important in recent years (Møller et al. 2014; Zhang et al. 2015; Bondarenko et al. 2013). Moreover, the relatively high exposure of humans to some heavy metals (Hengstler et al. 2003; King et al. 2015; Jaishankar et al. 2014; Tom and Fletcher 2014; Shiue and Hristova 2014; Pizzino et al. 2014; Jung et al. 2003) has motivated intensive research on metal toxicity, including nickel-induced DNA damage (Yao and Costa 2014), manganese-induced neurotoxicity (Krishna et al. 2014; Kumasaka et al. 2014), and lead-associated mimicry of essential minerals and immunotoxicity (Breton et al. 2013; Jorissen et al. 2013). As a result, the review presented by Valko and colleagues is extremely relevant to scientists working in these fields of research.

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