

Exploring toxicity induced by gadolinium ions on sea urchin embryos: Differentiation among phylogenetically distant species and focus on stress response and skeletogenesis

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Abstract

Pharmaceuticals are a class of emerging environmental contaminants. Gadolinium (Gd) is a lanthanide metal whose chelates are employed as contrast agents for magnetic resonance imaging, and subsequently released into the aquatic environment. We investigated the effects of exposure to sub-lethal Gd concentrations on the development of four phylogenetically and geographically distant sea urchin species: two Mediterranean, *Paracentrotus lividus* and *Arbacia lixula* and two from Australia, *Heliocidaris tuberculata* and *Centrostephanus rodgersii*. Sensitivity to Gd greatly varied, with EC₅₀ ranging from 56nM to 132 μ M across the four species. Measures of the Gd and Ca content inside embryos showed a time- and dose-dependent increase in Gd, in parallel with a reduction in Ca. In all the four species, we observed a general delay of embryo development at 24h post-fertilization and a strong inhibition of skeleton growth at 48h. Further experiments were carried out on *P. lividus* embryos: RT-PCR gene expression analysis showed the misregulation of several genes implicated both in the skeletogenic and the left-right axis specification networks. WB analysis showed an increase of the LC3 autophagic marker at 24 and 48h. Confocal microscopy studies confirmed the increased number of autophagosomes and autophagolysosomes and showed no apoptotic induction. The results show the hazard of Gd in the marine environment, indicating that Gd is able to affect three different levels in sea urchin embryos: morphogenesis, stress response such as autophagy, and gene expression. Results highlight that pollution assays based on only one species can be misleading with respect to hazard risk assessment.

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Biography

Chiara Martino is a third year PhD student in Cellular Biology at the University of Palermo, Italy. During her PhD, she spent six months at the University of Sydney to compare the effects of

marine pollutants between Mediterranean and Australian sea urchin species. Her research interests lie in ecotoxicology, cellular and molecular biology and development. She has published 4 papers in reputed journals and has been a speaker for more than 10 national and international conferences.