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Mechanisms of response to NMs in soil invertebrates – integrating from gene expression to organism effect and AOPs

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Abstract: High-throughput gene expression tools can help understanding the mechanisms of toxic-mediated responses. Further, one of the main aims is to establish the link between alterations in macromolecules (genes, proteins) and their biological implications at higher levels (reproduction). Such data can be integrated via Adverse Outcome Pathways(AOPs) approach, and provide input towards a more knowledge based risk assessment. In the present study we investigated the mechanisms of toxicity for Cu (copper) and Ag (silver) materials using the high-throughput tool for the soil worm *Enchytraeus crypticus* (Oligochaeta), a 4x44K custom Agilent microarray. Testing was done based on reproduction effect concentrations (EC20, EC50) using 3 and 7 days of exposure. The materials included CuNP, Cu nanowires, Cu aged (80 years contaminated field) and Cu salt plus AgNP (non coated and PVP coated), AgNM300k (dispersed) and Ag salt.

Results indicated specific mechanisms of response for the different materials tested. Cu-salt exposure affected mechanisms related with calcium homeostasis and activated the chemosensory system of the enchytraids. Energetic metabolism was affected differently depending on the copper forms. For Ag, results showed that one of the materials caused a more differentiated transcriptomic profile than the others. Commonly and across all Ag forms were the effects on cell cycle control associated with impairment of DNA repair mechanism.

The study of gene expression pointed at differences in gene responses that would had been absent via the standard methods alone. The AOPs approach is a promising means to overview effects in an integrated flow.

Primary author: AMORIM, Monica J. B. (Univeristy of Aveiro)

Co-author: GOMES, Susana I. L. (Univeristy of Aveiro)

Presenter: AMORIM, Monica J. B. (Univeristy of Aveiro)

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