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Transcriptomic modulations induced by cadmium, samarium and gadolinium in the blue mussel (*Mytilus edulis*)

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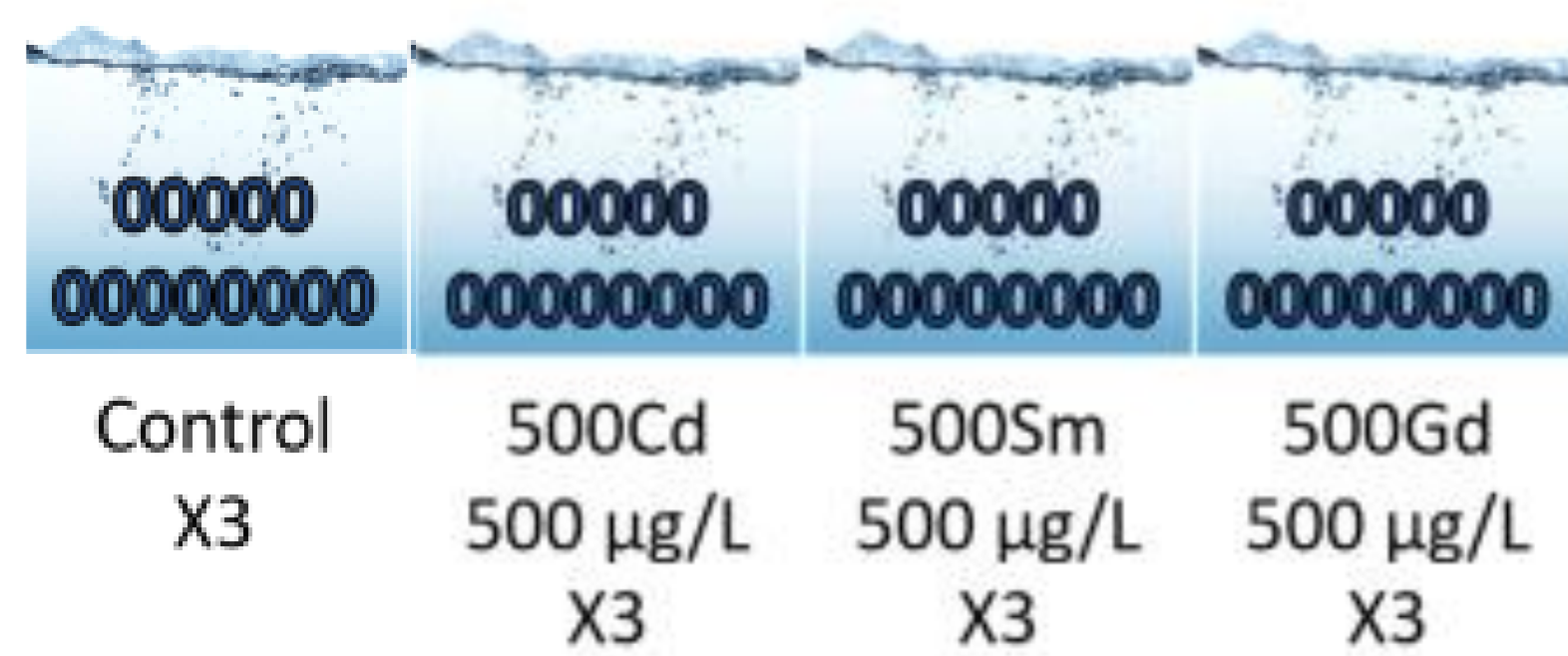
Introduction

Studying the environment involves a blend of tools that analyze physiological responses, crucial for evaluating environmental risks and deepening our grasp of how chemicals affect organisms. While comprehensive regulations exist for certain chemicals like cadmium due to their known impact on the environment, there's a growing awareness of the environmental toxicity of rare earth elements (REEs). Despite their widespread use in industry, this aspect has only started to gain attention in recent years. This work follows a previous study that examined the biochemical and metabolomics effects of cadmium, gadolinium and samarium in three *Mytilus edulis* organs: the digestive gland, the gills and the mantle. Here we characterized transcriptional effects of these three metals on cell signaling pathways regulating cell proliferation, apoptosis, stress, detoxification and energy metabolism by RT-qPCR.

Experimental Design

Laboratory Exposures (8 days)

- Aerated artificial seawater (33 PSU, 15°C)
- Artificial light of 12:12 h
- 13 L tanks, 13 mussels per tank
- 12 tanks (3 per condition)
- Changes of water every 2 days with contamination and feeding



Sampling

Sacrifices using liquid N₂



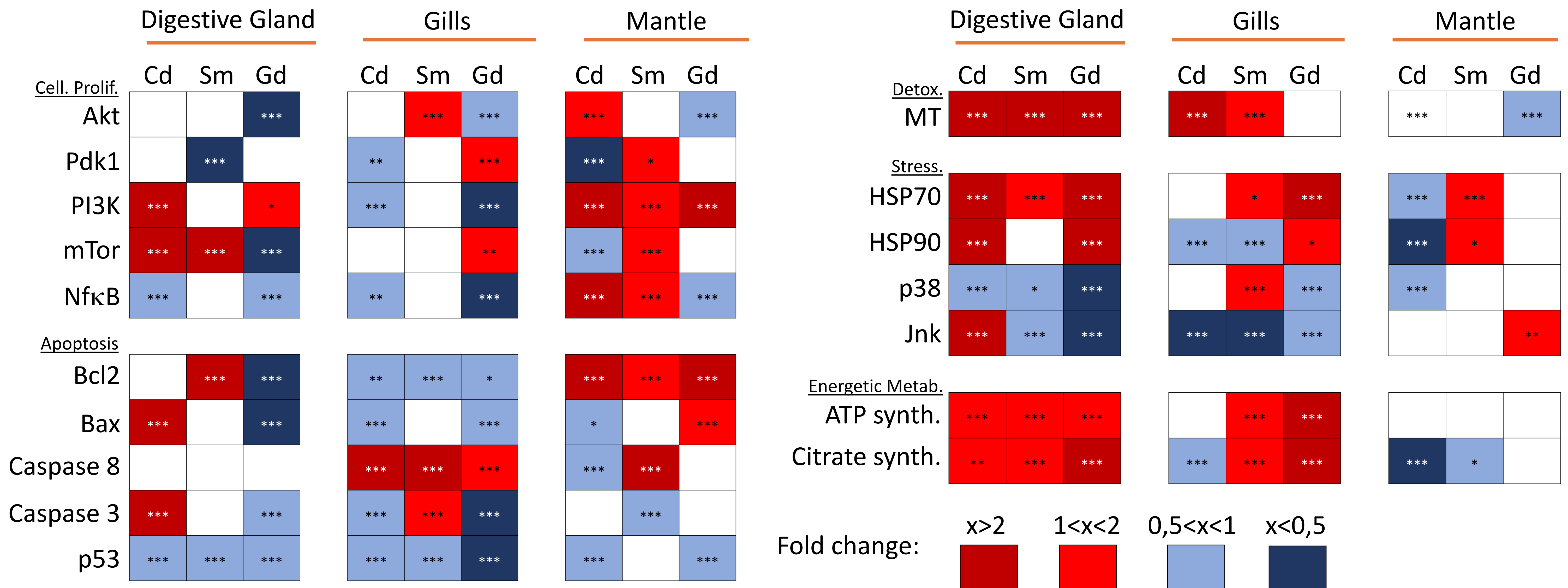
Analyses in 6 mussels per condition (2/tank)

RT-qPCR Analysis



- Cell proliferation
- Apoptosis
- Stress
- Detoxification
- Energetic metabolism

Relative gene expression in three tissues of mussels exposed to Cd, Sm or Gd concentration of 500 µg/L during 8 days



Target gene expression was assessed in relation to 18S control gene and the respective control treatment, using threshold cycles and the 2^{-ΔΔCt} comparative method. Genes expression was documented for the three tissues and the three metals studied. Cd: cadmium; Sm: samarium; Gd: gadolinium; MT: Metallothionein. Kruskal-Wallis test: * p < 0.05; ** p < 0.01; *** p < 0.001

Conclusion

- All five pathways are differentially regulated at transcriptional level in the three tissues.
- All five pathways are differentially regulated at transcriptional level by the three metals.
- **Main trends:**
 - High MT induction in **digestive glands** and **gills** - High induction of **proliferative genes** by **Sm** in the **mantle**
 - High **HSPs** and **energetic** metabolism induction in **digestive gland**
- Biochemical, metabolomics and **transcriptomic approaches are complementary tools in Environmental Risk Assessment**