# A148 · Beyond single-organ pathology: Mapping a unified toxicogenomic network of heavy metal cardiotoxicity and neurotoxicity

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# Beyond single-organ pathology: Mapping a unified toxicogenomic network of heavy metal cardiotoxicity and neurotoxicity

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**Abstract**

Environmental exposure to toxic heavy metals, particularly lead and cadmium, poses multi-system health risks. Yet, traditional toxicological models evaluate cardiotoxicity and neurotoxicity as independent phenomena. This study utilizes systems-level computational toxicogenomics to map shared molecular networks disrupted by lead and cadmium across human cardiac muscle and cerebral cortex tissues. Multi-set intersection filtering across public toxicogenomic repositories isolated a universal consensus core of 1,617 genes altered across all four exposure-tissue conditions, representing 19.05% of the total target space. Topological network analysis identified five hub genes driving cellular homeostasis: TP53, AKT1, GAPDH, ACTB, and MYC. Functional enrichment analysis mapped their related pathways across five primary biological axes: bioenergetic failure, PI3K-Akt survival signaling, transcriptional stress, cytoskeletal breakdown, and p53-mediated apoptosis. These findings demonstrate that heavy metal pathology across cardiac and neurological systems converges upon a single conserved molecular network, providing a multi-target framework for risk-assessment follow ups.

**Keywords:** toxicogenomics, network analysis, heavy metal toxicity, systems biology