Biomarkers for health effects of exposure to advanced materials in mixtures

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Abstract
This presentation will discuss the recent developments in human biomonitoring efforts for early disease detection resulting from exposures to inhaled or ingested (engineered) nanoparticles in mixtures. Advanced materials have reached large scale production and have become widely used in consumer goods due to their superior technical performance. Workers and consumers are being exposed on a regular basis to these materials across the product life cycle, from synthesis to end-of-life. Newer scenarios that involve advanced materials and chemistries (e.g. hybrid surface functionalized nanoparticles in polymers) have gained interest due to the re-emergence of aggressive forms of old lung diseases such as acute lung failure, accelerated silicosis, COPD and asthma. We will draw from our group's research and major developments in the field to address four major themes: (i) innovative study designs that meet sample size/power needs and limited budgets; (ii) biomarker selection and its trade-offs, with an emphasis on three distinct options- a single biomarker, curated panels of biomolecular markers, or multi-omics; (iii) association vs causation, especially as it relates to the role of advanced materials in the observed outcomes; and (iv) interpretation of the clinical utility of biomarkers in the absence of upper normal clinical reference values. We will use examples from the commonly measured biomarkers of oxidative stress and inflammation to illustrate some of the challenges and progress to-date.

Figures

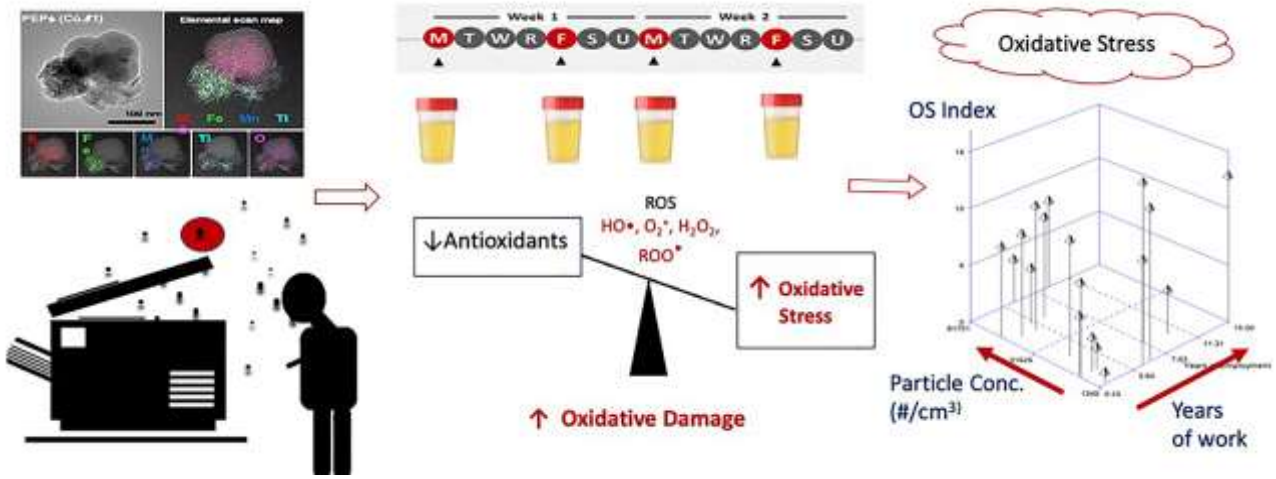

Figure 1: Example of urinary markers of oxidative damage in print shop operators.