NATIONAL ACADEMIES Sciences Engineering Medicine

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WEBINAR SERIES

NATIONAL ACADEMIES Sciences Engineering Medicine

Microplastics and Health: Research Priorities, Mitigation Strategies, and Public Communication in the Face of Uncertainties

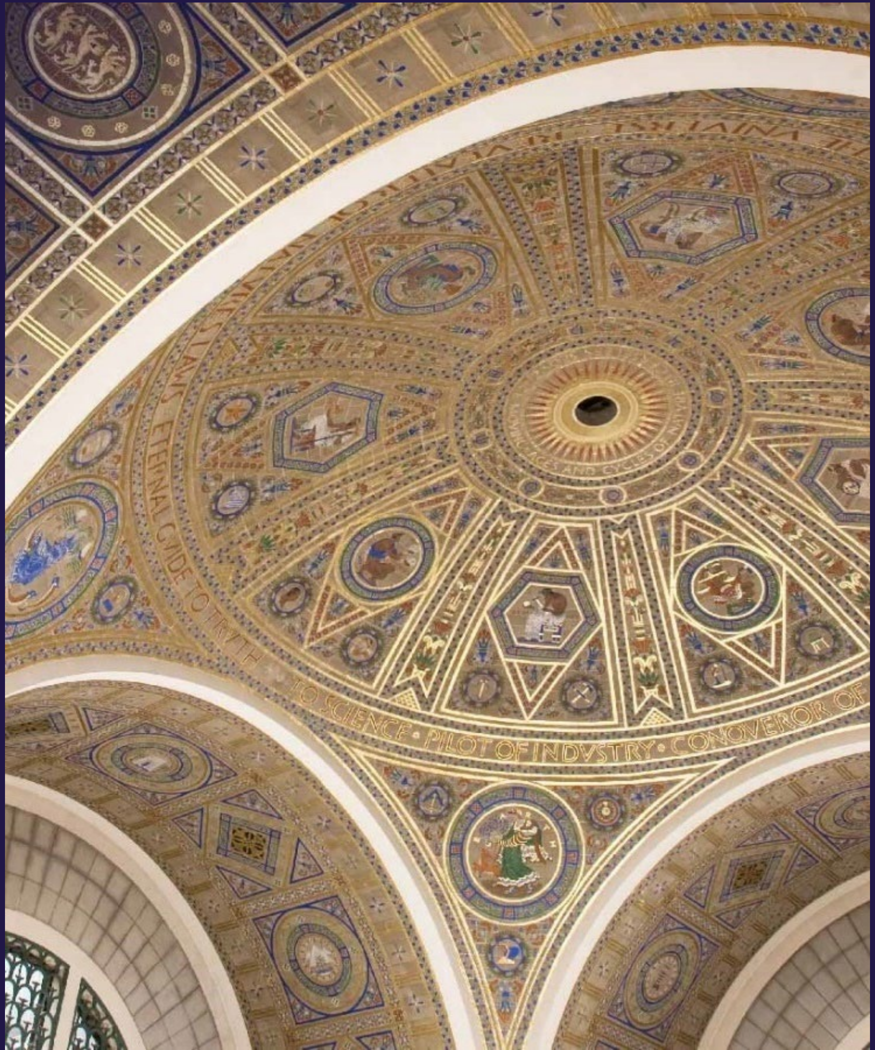
June 9, 2025 | 11:00 AM-1:00 PM ET

Webinars Recap

Research Gaps/Challenges

And

Key Pathways and Priorities



The Challenge

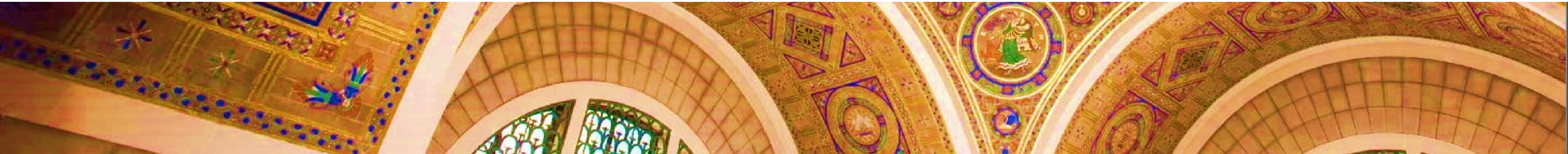
Standardization and Methodological Limitations

- ➢ No universal protocols for sampling, analysis, or reporting
- ➢ Inconsistent quality assurance/control (QA/QC)
- ➢ Lack of certified reference materials
- ➢ Poor reproducibility across labs
- ➢ No centralized data repository

The Pathway

Standardization and Quality Control

- Harmonize methods for sampling, extraction, and analysis across environmental and biological matrices.
- Adopt QA/QC protocols aligned with ISO and ASTM standards.
- Develop certified, environmentally realistic reference materials.
- Expand interlaboratory method validation studies.



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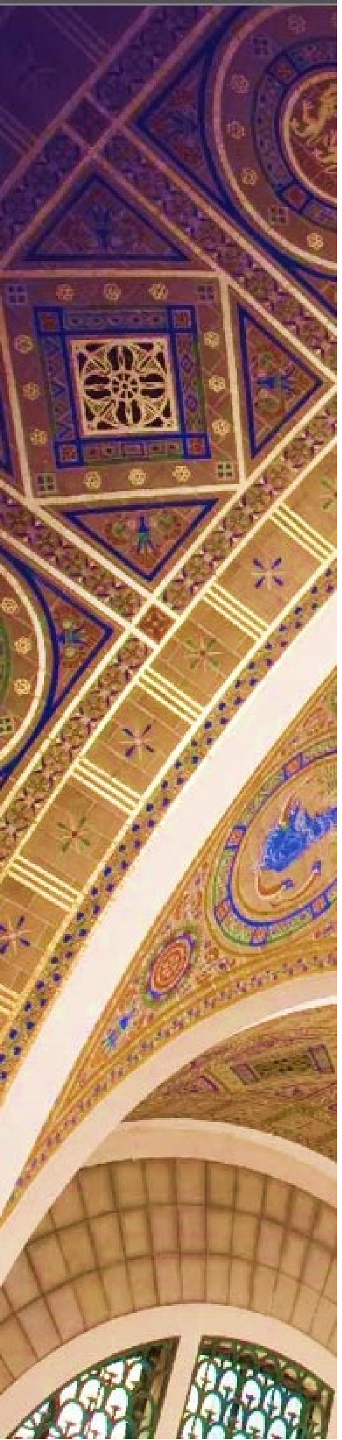
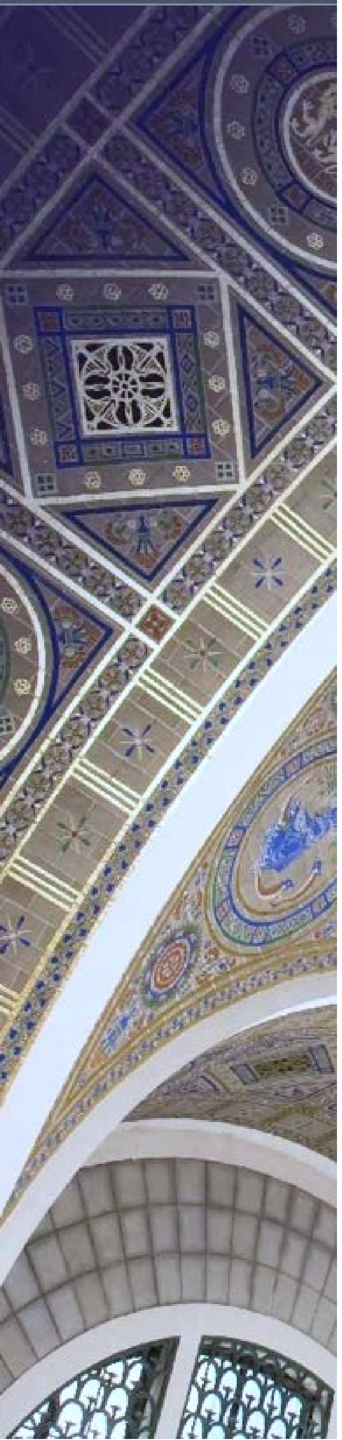


The Pathway

Data Infrastructure and Transparency

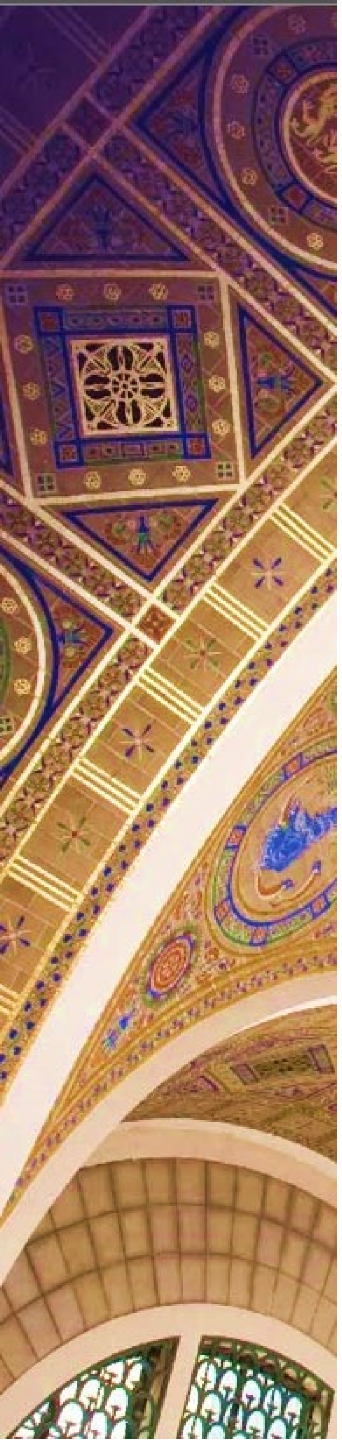
- Establish centralized, open-access databases for exposure, toxicity, and health data.
- Promote use of shared reporting standards and method repositories.
- Expand platforms like TOMEx and EPA chemical dashboards.



The Challenge

Analytical and Detection Challenges

- Detection technologies struggle with particles <10–20 microns
- Analytical tools (Raman, FTIR, GC-MS) face matrix interference
- High risk of sample contamination
- Expert interpretation is often needed



The Pathway

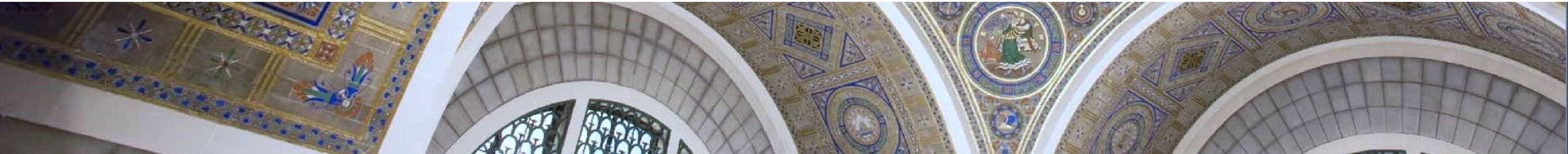
Analytical and Detection Innovations

- Advance technologies to detect particles <10 microns, especially <1 µm.
- Invest in emerging technologies for improved detection (e.g., microcavity assays, hyperspectral imaging, and nano-flow tools).
- Leverage AI and machine learning for automated particle identification and data analysis.
- Strengthen collaboration between toxicologists and Analytical chemists to ensure the generation of high-quality data

The Challenge

Complexity of Microplastics, Behavior, and Fate

- Microplastics vary in size, shape, polymer type, aging, and additives
- Chemical complexity and co-exposures
- Limited knowledge on interaction with biofilms and tissues
- Lack of understanding about degradation and transport across air, water, and soil
- Risk assessment frameworks are not suited for complex mixtures



The Pathway

Environmental and Biological Relevance

- Use weathered, mixed polymer particles to simulate real-world exposure.
- Study underrepresented matrices such as compost, placenta, brain tissue, and sediment.
- Investigate how particles interact with biofilms and undergo environmental transformation.
- **Collaboratively** develop integrated risk assessment approaches that combine exposure, hazard, and physicochemical data for regulatory use (e.g., MARII).

The Challenge

Human Exposure and Health Effects

- Human exposure estimates vary widely
- Poor understanding of internal distribution and bioaccumulation
- Limited epidemiological and prenatal studies
- Lack of environmental relevance of toxicological models
- Inconsistency in toxicity studies
- Underutilized occupational exposure data
- Exposure disparities in vulnerable populations

The Pathway

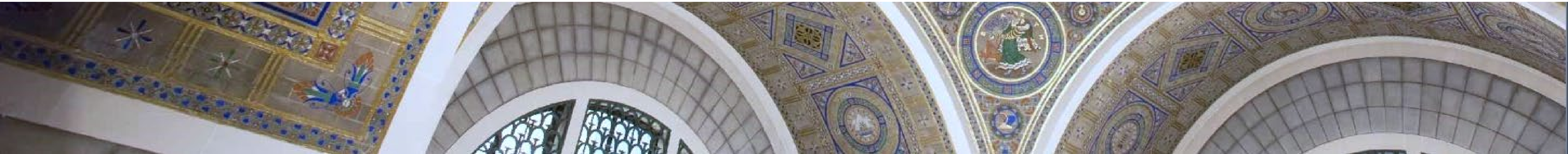
Exposure and Toxicology Research

- Improve PBPK models and in vitro platforms to simulate internal distribution and effects.
- Examine dose-response relationships and mechanisms (inflammation, fibrosis, oxidative stress).
- Expand epidemiological and longitudinal cohort studies (e.g., Aurora Project).
- Prioritize vulnerable populations, including infants and pregnant individuals.

The Challenge

Integration, Collaboration, and Regulatory Gaps

- Toxicology studies are difficult to align
- Lack of interdisciplinary coordination (toxicology, chemistry, etc.)
- Regulations lag behind emerging evidence
- Insufficient data for setting regulatory thresholds



The Pathway

Interdisciplinary and Cross-Sector Collaboration

- Foster cross-sector collaboration and partnership between toxicologists, epidemiologists, policy makers, and regulators.
- Supports the development of standardized terminology.
- Use lessons from air pollution and research on nanoparticles to shape models.
- Promote educational outreach and knowledge transfer