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New Takes on Emerging Contaminants: Preface

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Since the 1990s, there has been a strong interest across the environmental science community in characterizing the threats to human health posed by emerging contaminants. Much of this research has focused on pharmaceuticals and personal care products in Europe and North America. However, the range of chemicals evaluated has expanded dramatically over the past three decades. This expansion raises a key challenge. Given that there may not be sufficient resources to fully evaluate all chemical classes for risks to human health and the environment, which chemical classes should be prioritized? Given the dramatic growth of China's economy and concurrent growth in environmental challenges, Chinese researchers are well-placed to address this challenge. The Environmental Processes and Risks of Chemical Contaminants Symposium, convened by the National Natural Science Foundation of China in Xiamen, China over November 30-December 2, 2016, brought together experts from around the world, and showcased the prowess of emerging Chinese researchers addressing these challenges. This Special Issue by the *Journal of Environmental Sciences* provides a collection of 16 papers from participants at this conference that highlight some of the critical issues and novel approaches addressed.

A starting point for evaluating which chemicals may pose environmental threats is predicting which are likely to occur in the environment. Chung et al. (2017) used a non-target screening analysis to demonstrate that chemicals measured in air and water were largely those expected to partition to these phases based on an equilibrium (fugacity) model.

While the potential occurrence of pharmaceuticals and personal care products in drinking waters has raised concerns among consumers, adverse impacts on human health have been difficult to demonstrate. However, the generation of antibiotic resistance in bacteria resulting from the occurrence of antibiotics has the potential to pose a significant threat to human health. This issue contains three papers addressing antibiotic fate, antibiotic resistance gene (ARG) detection and ARG induction. Bennett et al. (2017) used isotope ratio mass spectrometry to demonstrate that the decline in sulphanilamide concentrations in an aquifer were due to biodegradation rather than dilution. Riquelme et al. (2017) describe a gold nanosensor-based platform to measure ARGs at low concentrations in wastewater. Ye et al. (2017) discuss how exposure of bacteria to the mixtures of antibiotics likely to occur in impacted waters could promote the production of ARGs.

Due to their persistence and bioaccumulation potential, flame retardants represent clear risks to human health. Four papers in this issue address flame retardants. Morin et al. (2017) measured partitioning coefficients between water and different waste streams (e.g., plastics) containing flame retardants to predict which waste streams may represent the greatest potential to leach these contaminants. Wang et al. (2017a) developed a novel method to extract and measure chlorinated paraffins, an emerging class of flame retardants, in human placenta. Wang et al. (2017b) applied quantum chemical modeling of cytochrome P450 enzymes to predict metabolic products of emerging bromophenolic flame retardants. Kopp et al. (2017) demonstrated that flame retardants and other endocrine disrupting compounds can potentially promote obesity by modifying circadian rhythms in a fashion that disrupts lipid metabolism.

The other papers addressed important concerns for some of the classic contaminant classes, including modes of toxicity. Four papers addressed haloaromatic contaminants. Ma et al. (2017) demonstrated that copper and humic substances interacted to reduce the biodegradation of tetrabromobisphenol A, highlighting the importance of the experimental matrix for biodegradation studies. Zhang et al. (2017a) measured concentrations of halogenated dioxins and furans in air and dust near e-waste disposal and recycling facilities to demonstrate that, although concentrations had declined following tightening regulatory enforcement, concentrations still exceeded the tolerable daily intakes for children. Chen et al. (2017a) measured changes in the expression of genes in rat brains related to the nervous system after chronic, low-dose exposure to dioxins as a step towards understanding the potential for dioxins to induce neurological diseases in the elderly. Zhu et al. (2017) demonstrated that one of the modes of toxicity of haloaromatics can be triggered by their interactions with reactive oxygen species via halobenzoquinone intermediates.

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Four studies evaluated modes of toxicity associated with carbon and heavy metal contaminants. Gao et al. (2017) indicated that exposure to $PM_{2.5}$ reduced ATP production in adult mice, leading to neurodegeneration. Chen et al. (2017b) demonstrated that carbon nanomaterials inhibited lung surfactant and exerted a pro-inflammatory response in lung cells, potentially exacerbating lung fibrosis. Zhang et al. (2017b) found that nickel was a significant driver of toxicity to benthic organisms in the sediments of Lake Taihu. Jiang et al. (2017) demonstrated that nickel toxicity to wheat could be modeled by considering both complexation with ligands relevant to the rhizosphere and competition for such binding with other cations, particularly magnesium.

Taken together, these papers highlight the sophistication of the emerging cohort of Chinese environmental science researchers, not just for environmental chemistry, but also in toxicology. Future advances in this field likely will lie at the intersection of these two fields.

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