

Special Issue: Analytical Technologies in Metabolomics: Applications and Future Prospects

Sung-Fang Chen

Department of Chemistry, National Taiwan Normal University, Taipei, Taiwan

Metabolomics has emerged as one of the most dynamic disciplines in post-genomic science, providing holistic insights into metabolic networks and their roles in human health, disease mechanisms, and environmental responses. By integrating powerful analytical platforms—including liquid chromatography-mass spectrometry (LC-MS), gas chromatography-mass spectrometry (GC-MS), and nuclear magnetic resonance (NMR) spectroscopy—metabolomics enables comprehensive profiling of small-molecule metabolites that reflect physiological and pathological states. Recent advancements in analytical sensitivity, spatial resolution, and bioinformatics have propelled metabolomics from fundamental biochemistry to translational and clinical applications.

This special issue showcases technological innovations and their biomedical implications through original research and review articles. Key contributions include the evolution of Desorption Electrospray Ionization-Mass Spectrometry Imaging (DESI-MSI) for spatially resolved metabolic mapping, single-cell metabolomics revealing cellular heterogeneity and metabolic reprogramming in cancer, and NMR-based pediatric metabolomics providing insights into early-life health and disease prediction. The collection also explores environmental and toxicological applications, including PFAS exposure

studies, phthalate-induced lipid disruption in children, and chromatographic methods for analyzing gut microbiota-derived metabolites. In precision oncology, metabolomics elucidates cancer metabolism through the Warburg effect and metabolic reprogramming, while targeted LC-MRM-MS demonstrates how salivary metabolite biosignatures can support non-invasive oral cancer screening. These studies collectively illustrate how analytical precision and multidisciplinary integration are driving metabolomics toward clinical translation and personalized medicine.

The Guest Editors—Mei-Ling Cheng (Chang Gung University), Ching-Hua Kuo (National Taiwan University), and Sung-Fang Chen (National Taiwan Normal University)—are delighted to present this collection. We extend our sincere gratitude to all contributing authors for their innovative research, to the reviewers for their insightful comments, and to the editorial team of the Journal of Food and Drug Analysis for their professional support. We believe this special issue will inspire future research and foster collaboration across analytical chemistry, biomedical sciences, and clinical medicine, advancing the expanding frontiers of metabolomics in precision medicine, biomarker discovery, and systems-level understanding of biological complexity.