

Lipid-based signaling molecules for better diagnosis and novel treatment strategies

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Lipid-based signaling molecules are bioactive lipids or lipid derivatives that mediate a variety of biological signaling events both physiologically and pathologically. The multifaceted functions of lipid-based signaling molecules in pro-inflammation, anti-inflammation and pro-resolution comprise the complexity of their roles in inflammatory processes which in turn can provide opportunities to better understand the diseases with their deciphered characteristics. Therefore, the aim of this project is to develop a metabolomics-based method for profiling lipid-based signaling molecules in related diseases including cancers, autoimmune disorders and neurodegenerative diseases. It is expected that potential metabolic biomarkers can be identified and integrated with “omics” data for holistic interpretation from a systems biology perspective to achieve better diagnosis and offer novel treatment strategies.

In our research group, we developed a fast and comprehensive targeted ultra-high performance liquid chromatography–tandem mass spectrometry (UHPLC-MS/MS) method for profiling lipid-based signaling molecules. The platform enables simultaneous analyses of around 200 metabolites covering oxylipins, oxidative stress markers, known endocannabinoids and some bile acids. This targeted approach was shown to be sensitive, robust and reproducible characterized by various validation parameters. The platform applicability was demonstrated in various projects showing that the lipid-based signaling molecules are promising biomarkers in PDAC (Pancreatic ductal adenocarcinoma) stratification, potential treatment predictors in early rheumatoid arthritis and are indicators of APOE-linked Alzheimer’s disease pathology.