Metabolomic : From Single-Cell Insights to Clinical Diagnosis in Oncology

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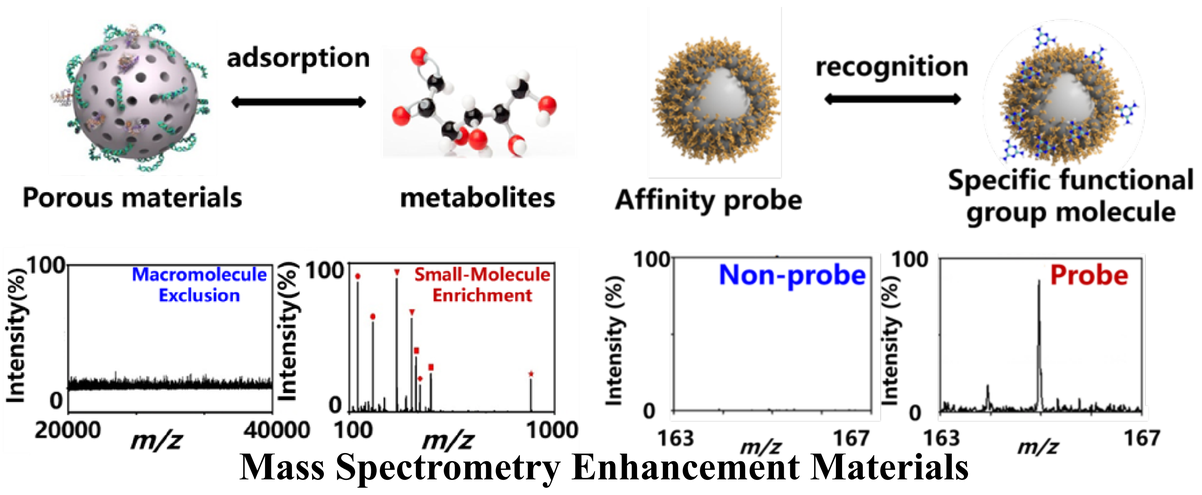
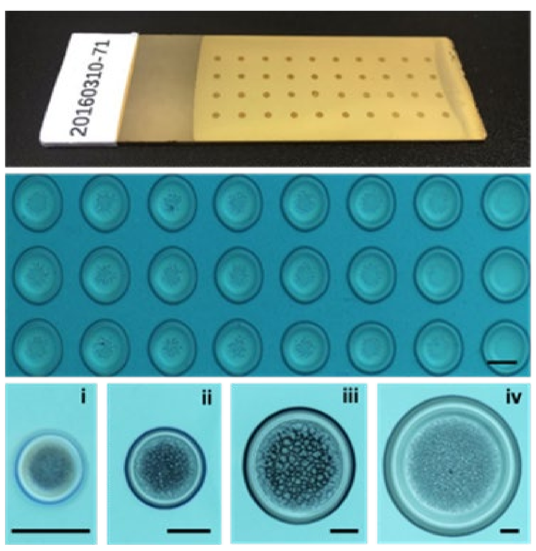
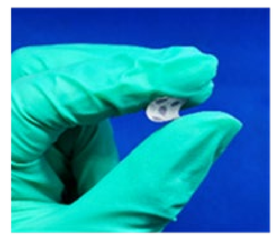
Our work enhances the sensitivity of mass spectrometry (MS) detection and the reliability of disease diagnosis by rationally configuring nanomaterials for enhancement, micro-nano chips, and wearable sensors. Our research bridges the gap between laboratory studies and clinical applications, expanding the currently limited metabolic targets in clinical use.

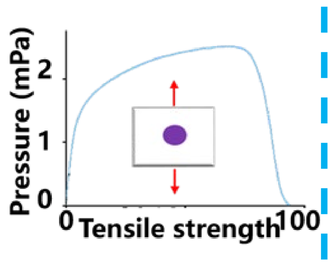


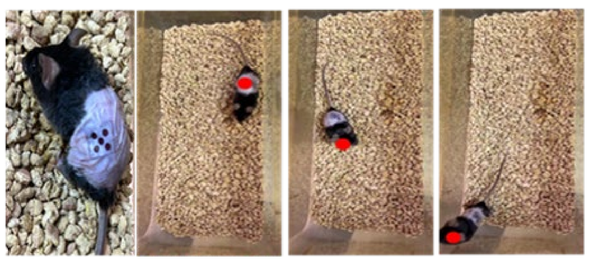
Mass Spectrometry Enhancement Materials



Solid-phase Chip

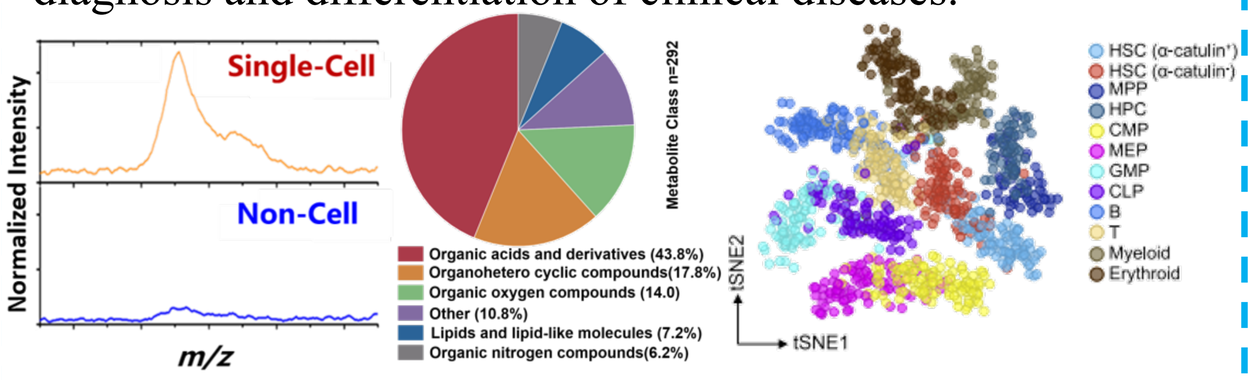




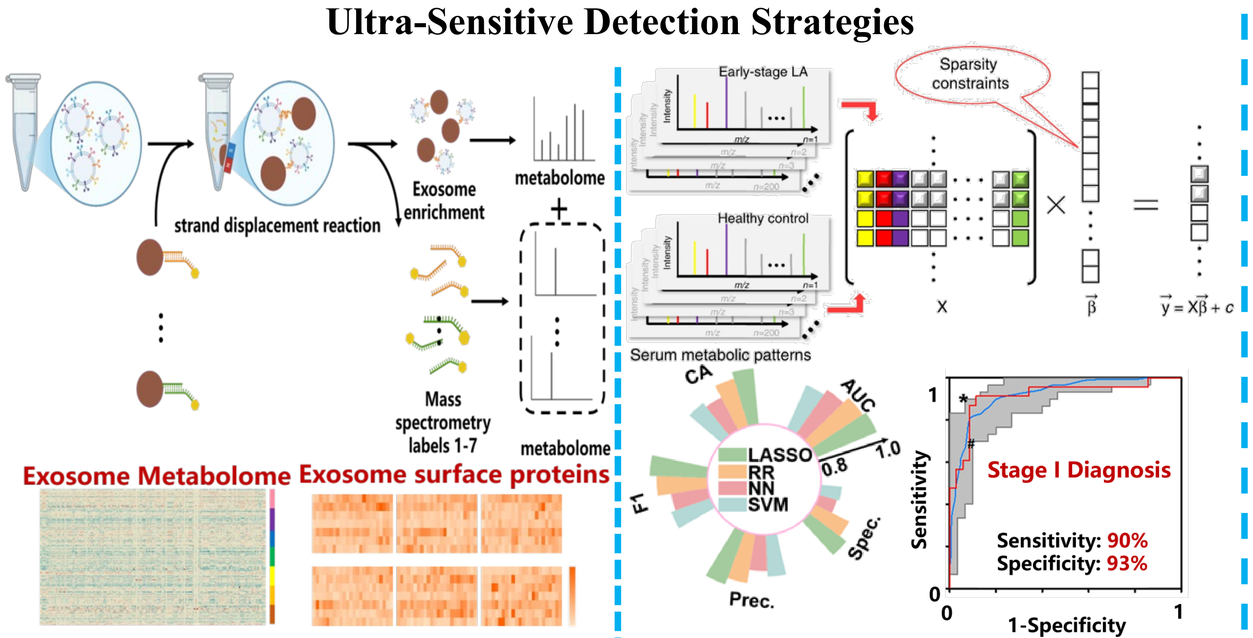


Wearable Device

We have developed a solid-phase MS diagnostic platform that enables metabolomics at the single-cell level through the optimization of nanomaterials. At the same time, we favor multi-omics collaborations based on MS analysis to achieve more comprehensive and enriched information annotation for diseases, aiding in early disease screening. In addition, the construction of machine learning models for large-scale clinical cohort samples enables us to achieve efficient diagnosis and differentiation of clinical diseases.

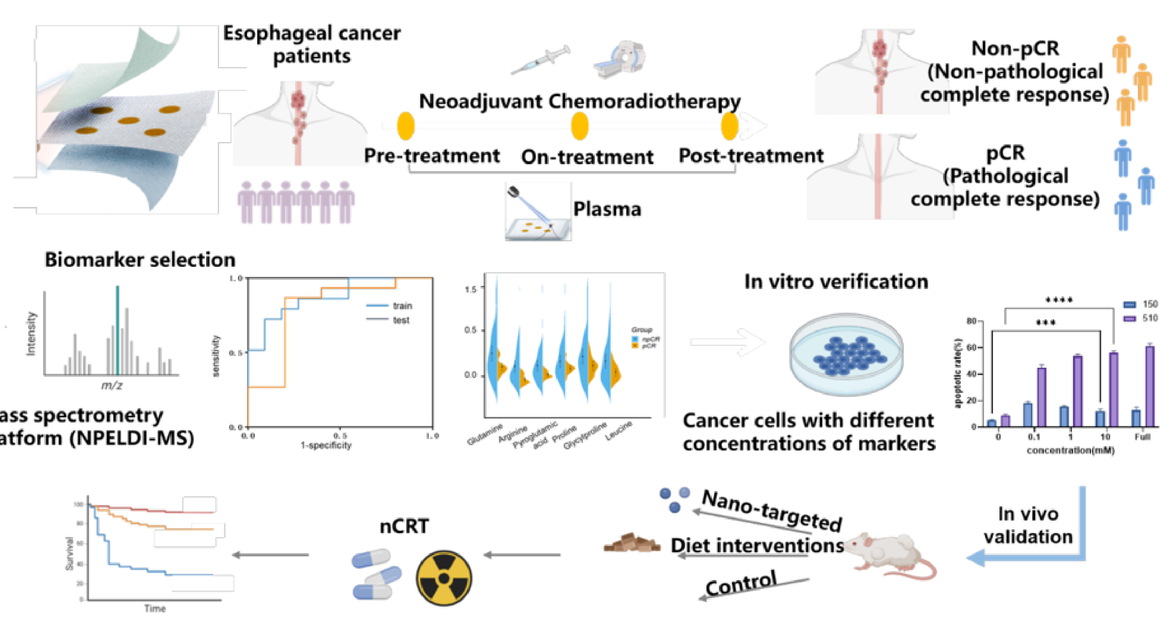


Ultra-Sensitive Detection Strategies

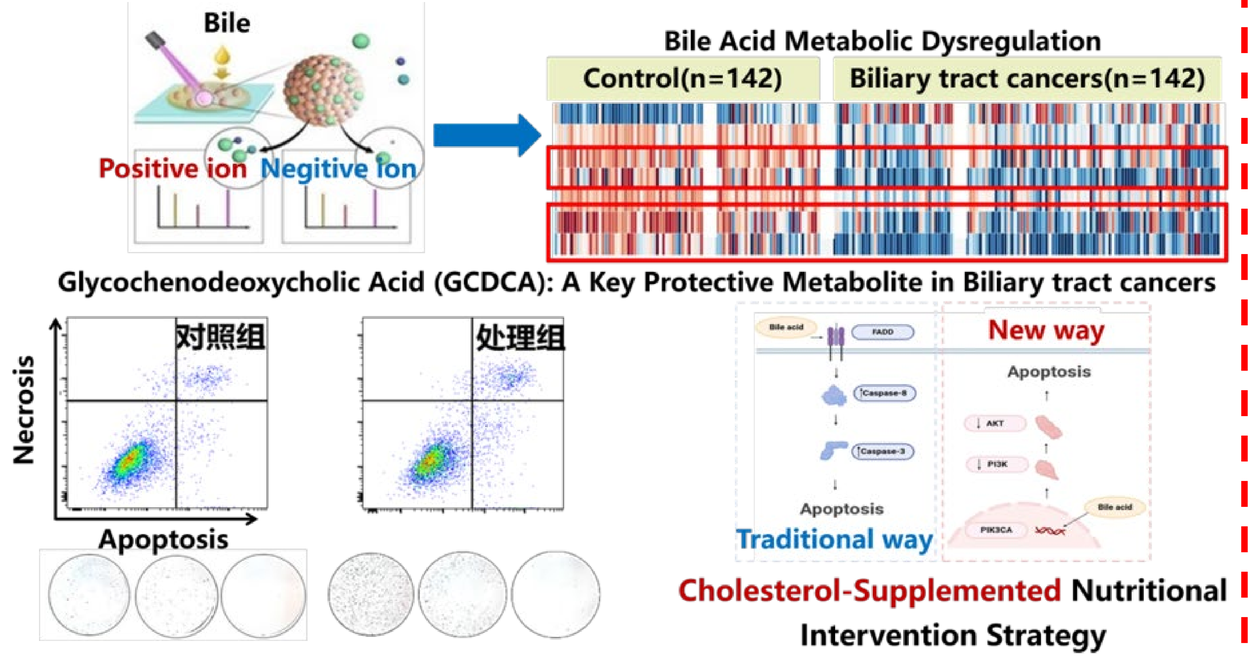


Multi-Omics **Machine Learning Models**

Our research establishes a standardized pipeline integrating cutting-edge metabolomics with clinical oncology. Two breakthrough visualization approaches exemplify this bench-to-bedside translation: 1. Time-Series Metabolic Radiotherapy Monitoring. The temporal metabolic profiling of esophageal cancer patients undergoing neoadjuvant chemoradiotherapy reveals dynamic biomarker patterns. Through serial plasma analysis using our NPELDI-MS platform, we identified: Pre-treatment metabolic signatures; On-treatment trajectory shifts; Post-treatment metabolic reset. 2. Biliary Metabolic Mapping for Target Discovery. Comprehensive bile acid profiling of 284 biliary tract cancer patients versus controls uncovered: Dysregulated cholesterol pathways driving tumor necrosis/apoptosis imbalance.



Time-Series Metabolomics-Guided Dietary Modulation



Biliary tract cancers Metabolic Target