【Outstanding Academic Research Meeting 1-1】

Metabolomics in the Identification of Disease-Associated Metabolites and Therapeutic Targets: From Discovery to Clinical Translation

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Metabolomics has emerged as a transformative approach for identifying biomarkers and potential drug targets that differentiate between healthy and disease states. While certain metabolites are essential for sustaining normal physiological functions, others can provoke harmful effects under stress. By analyzing comprehensive metabolic profiles, we can identify metabolites that serve as markers of specific physiological or pathological conditions, facilitating the development of targeted therapeutic strategies. Our research utilizes metabolomics to identify key metabolites that play significant roles in various diseases, including systemic inflammation, cancer, cardiovascular diseases (CVD), and diabetic conditions with renal complications. One notable finding is 5-methoxytryptophan (5-MTP), an endothelial-protective metabolite that preserves vascular integrity and mitigates systemic inflammation. 5-MTP has been shown to suppress LPS-induced inflammatory responses in macrophages and lung tissues, making it a promising candidate for anti-inflammatory drug development. Another critical discovery is succinate, an oncometabolite produced by cancer cells that promotes tumor-associated macrophage (TAM) polarization and metastasis. Succinate acts through the SUCNR1 receptor and initiates a PI3K-HIF-1α signaling cascade, contributing to tumor progression. This pathway positions succinate as a potential target for cancer therapies aimed at preventing metastasis. Through the integration of metabolomics with molecular, biochemical, and in vivo models, we have characterized these metabolites' roles in disease progression and therapeutic potential. The identification of 5-MTP and succinate as biomarkers and drug targets underscores the capability of metabolomics to drive innovations in disease treatment, aiming for improved patient outcomes through metabolite-focused interventions.