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Single Cell Spatial Metabolomics for Multiplexed Chemical Analysis

Category: Biotechnology and Medical Research

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Summary

This technology, Single Cell Spatially resolved Metabolic (scSpaMet) framework, integrates untargeted spatial metabolomics with targeted multiplexed protein imaging, allowing for the detailed profiling of metabolic and protein interactions within individual immune and cancer cells across various human tissues. By combining 3D spatially resolved metabolic profiling with imaging mass cytometry, scSpaMet provides unprecedented insights into the metabolic reprogramming of cells in the context of cancer and immune responses.

Development Stage

Prototype Complete

Problem Statement & Solution

The relevance of advanced cellular analysis technologies is increasingly critical in fields such as oncology and immunology, where understanding the intricate interplay between metabolic processes and protein functions within cells can lead to groundbreaking therapeutic advancements. Traditional metabolic imaging technologies face significant challenges in achieving precise single-cell mapping and often struggle with linking specific cell types to their metabolic profiles in densely packed tissues. Additionally, current mass spectrometry imaging (MSI) methods lack the necessary resolution and specificity needed for detailed cellular analysis.

Researchers at the Georgia Institute of Technology have developed the Single Cell Spatially resolved Metabolic (scSpaMet) framework, an innovative technology that combines untargeted spatial metabolomics with targeted multiplexed protein imaging. This integration facilitates the detailed profiling of metabolic and protein interactions within individual cells, providing unprecedented insights into cellular functions and disease mechanisms.

Advantages

- Enables joint protein-metabolite profiling at the single-cell level.
- Provides detailed spatial metabolomic maps of individual cells within native tissues.
- Reveals cell type-dependent metabolite profiles and metabolic interactions.
- Utilizes deep learning for the identification of unique metabolite states within cell types.
- Facilitates understanding of metabolic patterns along cell differentiation paths.

Commercial Applications

- Drug discovery and development for cancer and immune-related diseases.
- Personalized medicine through detailed analysis of patient tissue biopsies.

- Research in cellular metabolism, particularly in understanding the tumor microenvironment.
- Development of diagnostic tools for early detection of metabolic alterations in diseases.

Lead Inventor: Ahmet F Coskun, PhD

Intellectual Property Status: US Patent Issued- US20240069031A1

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