

Novel 3D Reconstruction of Healthy and Diseased Liver Architecture Using Cyclic Immunofluorescence and Desorption Electrospray Ionization (DESI) Mass Spectrometry Imaging (MSI)

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The mammalian liver plays a pivotal role in numerous essential functions, including metabolism, detoxification, bile secretion, protein synthesis, and nutrient storage and uptake. However, a thorough understanding of the liver's intricate organization and regulation at the single-cell level remains incomplete. We present a novel approach to this challenge, utilizing a cyclic immunofluorescence workflow known as iterative bleaching extends multiplexity (IBEX) to investigate the liver's cellular landscape. By employing a diverse panel of antibody markers targeting key cellular components, including the hepatocytes in the portal triad-central vein axis, lymphatics, endothelial cells and immune cells, we aim to capture the metabolic zonation and cellular landscape within the three-dimensional architecture of the liver. Additionally, we aim to integrate the Cyc-IF results with high-resolution images generated by desorption electrospray ionization (DESI) mass spectrometry imaging (MSI), culminating in a comprehensive metabolic and cellular reference map of this vital organ. This resource can thus serve as a guide in unraveling the intricate functions of the liver and its cell-cell interactions in healthy and disease states.