

Visualizing Therapeutics at the Subcellular Scale by NanoSIMS

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The effectiveness of therapeutics is strongly influenced by their ability to reach the right tissues, cells, and subcellular compartments. To better understand therapeutic efficacy and potential side effects, it is essential to map their distribution within biological systems. In recent years, our lab, together with our collaborators, has developed and demonstrated a multimodal correlative imaging approach that combines light, electron, and NanoSIMS imaging, enabling the visualization of a diverse range of therapeutics at subcellular resolution in cells and tissues. We have mapped various small-molecule therapeutics containing elements with low biological background, such as iodine, bromine, and arsenic. Additionally, we have employed elemental and isotope labeling to enhance our ability to map a broader array of therapeutics in cells and tissues, including nucleic acid-based therapeutics. Our studies revealed that therapeutics target distinct subcellular compartments, and that subcellular drug compartmentalization affects overall drug efficacy.