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High-Resolution Chemical Imaging of Cells and Tissues

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Innovations in high-resolution optical imaging have allowed visualization of nanoscale biological structures and connections. However, super-resolution fluorescence techniques, including both optics-oriented and sample-expansion based, are relatively limited in quantification and throughput especially in tissues from photobleaching or quenching of the fluorophores, and low-efficiency or non-uniform delivery of the probes. I will present our recent efforts to develop a general sample-expansion vibrational imaging strategy for label-free high-resolution (to below 100 nm) chemical imaging in cells and tissues. With further adoption of machine learning training, we successfully obtained label-free, multi-component, and volumetric prediction of nucleus, blood vessels, neuronal cells, and dendrites in complex mouse brain tissues.