Label-free imaging using intrinsic molecular spectroscopy signals is opening a new window for watching biomolecules and nanomaterials at work in live cells and inside the human body. We have made advances to allow real time vibrational spectral imaging of cellular processes, extraction of information from the crowded fingerprint bands, and vibrational imaging of a tissue that is a few centimeters deep under the surface. Our most recent advances in both development and applications of spectroscopic imaging platforms will be presented, including deep tissue imaging by acoustic detection of harmonic molecular vibration, study of altered cholesterol metabolism in cancer by Raman scattering microscopy, and super-resolution imaging of nanomaterials by transient absorption microscopy.

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