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Optical Exploration of Cellular Microenvironments JOSHUA WEBER, KEVIN ELICEIRI, University of Wisconsin - Madison, LABORATORY FOR OPTICAL AND COMPUTATIONAL INSTRUMENTATION TEAM — Cell function and behavior are influenced by various local factors. The cellular microenvironment includes surrounding cells and the extracellular matrix, molecules and proteins that provide structural and functional support. In addition to the local chemistry, the physical properties of these environs affect cell behavior, as do the mechanical forces they exert. At the Laboratory for Optical and Computational Instrumentation, we use multiple optical imaging modalities to explore cellular microenvironments. A principle tool is multiphoton fluorescent excitation microscopy. Based on non-linear effects, this technique reduces scatter and allows for deeper optical exploration. This is particularly useful in 3D tissue imaging, as it permits optical sectioning of intact tissues. Fluorescence lifetime microscopy reveals environmental effects through variations in the delay between excitation and decay. With spectral discrimination, multiple fluorophores, and thus multiple aspects of the environment, can be examined concurrently. We also experiment with high-speed time-of-flight techniques based on indirect scattering, which permit imaging of otherwise inaccessible regions. With these imaging modalities, we explore cellular microenvironments in a range of biological samples.

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