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BIOTRANSPORT IN OPTICAL DIAGNOSTICS, IMAGING, AND THERAPY

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BIOTRANSPORT IN OPTICAL DIAGNOSTICS, IMAGING, AND THERAPY

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Non-invasive characterization and manipulation of tissue structure and function across spatial scales is one of the most challenging problems facing the use of optical techniques in biomedicine. A broad technical goal for the use of optical methods is the non-invasive measurement and/or manipulation of tissue structure and function on the microscopic scale while preserving the ability to interrogate the largest possible tissue volume. This overall goal has resulted in a plethora of optical diagnostic, imaging, and therapeutic methodologies that utilize specific light-tissue interactions and exploit various endogenous and/or exogenous optical contrast elements.

These methodologies raise the prospect that optical methods may provide a single platform for the imaging, detection, and treatment of biological tissues with resolution and depth sensitivity on spatial scales ranging from nanometers to centimeters. A focus of this presentation is an exposition of the spatial and temporal scales governing the transport of laser radiation, as well as the thermal and mechanical processes that may result. An understanding of the characteristics of these transport processes is critical to assessing the information content in diagnostic signals as well as the specificity and efficacy of various treatment approaches. These needs for improving current approaches for optical diagnosis and therapy motivate specific challenges for the modeling and experimental validation of these transport processes on the nano-, micro-, meso-, and macro-scopic spatial scales.

