

Special Issue

Optical Probes and Bioimaging: Recent Developments and Challenges

Message from the Guest Editors

The past decade has witnessed a transformative evolution in optical probes and bioimaging, propelled by groundbreaking advancements in nanomaterial engineering, including plasmonic nanomaterials and fluorescence probes, and genetically encoded sensors. These developments have significantly enhanced in vivo imaging capabilities, achieving superior resolution, sensitivity, and multiplexing performance. Concurrently, second near-infrared window (NIR-II) imaging combined with artificial intelligence (AI)-powered analytics has unlocked novel possibilities for real-time deep tissue visualization. However, challenges persist regarding biocompatibility issues, the potential long-term toxicity of probes, and scattering effects in complex biological environments. Current research emphasizes hybrid approaches that merge optical methods with synergistic technologies, augmented by machine learning for sophisticated multimodal data interpretation. Addressing these challenges will position optical bioimaging as a cornerstone of precision medicine, transforming both diagnostic frameworks and therapeutic monitoring.

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