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The Future of Optical Microscopy: Innovations and Breakthroughs

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Message from the Guest Editor

The documented applications of light for imaging purposes by various scientists from the east side of the planet to the west of it date back thousands of years. The development of microscopes in the late 16th century revolutionized the imaging world. After the theory of electricity and magnetism was developed by scientists, manipulating light advanced imaging technologies, and researchers started exploring the microscopic world and describing various organisms and structures. The emergence of imaging modalities like phase contrast and fluorescence microscopy in the 19th century and sub-diffraction optical microscopy in the late 20th century advanced the field to a new level. Now, we can control various properties of the photons, such as the spatial and polarization states, phase, laser repetition rate, wavelength, scanning speed, and other characteristics that can be manipulated in favor of better imaging. They have expanded our imaging capabilities, facilitating research in various fields, including biology, materials science, and even nanotechnology. Moreover, the integration of microscopy and nanoscopy with computational techniques has enabled the visualization and analysis of complex biological systems in unprecedented detail, paving the way for advancements in biomedical research and beyond.

This Special Issue invites manuscripts that introduce the recent advances in optical microscopy. All theoretical, numerical, and experimental papers are accepted. Topics include, but are not limited to, the following:

- New imaging techniques for biology applications: hardware designs, beam structures, and photon manipulations.
- Advances in theoretical biophotonics.
- Computational methods in optical microscopy.
- Imaging and spectroscopy in biomedical sciences.
- Multimodal biomedical imaging techniques.
- Translational and clinical biomedical optics.
- Quantum light and biology applications.

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