
Preface

Live cell imaging has now become a routine tool in biomedical and life science research. It is hard to imagine an active academic research department, pharmaceutical or biotechnology company without access to this technology and without using it on a regular basis. Over the last decade, major progress in this area has been achieved, making this core biochemical, cell and molecular biology techniques even more versatile, affordable, and mature. On the other hand, we continue witnessing numerous new, breakthrough developments which advance this technology even further, extending its capabilities and measurement standards. A variety of advanced-imaging methodologies, probe chemistries, experimental procedures, dedicated instruments, integrated systems, and a large number of new applications have come to the fore very recently. One can mention, for example, ultra-high resolution methods breaking the canonical diffraction limits, multi-photon excitation imaging and sample manipulation (e.g., (un)caging, permeabilization), new chemically and genetically engineered probes for key markers and parameters of cellular function, multi-color imaging, specialized detection formats, custom-built systems employing new optoelectronics and engineering solutions, user-friendly multi-mode microscopes, software, and data analysis algorithms. All this provide unprecedented opportunities for the real-time investigation of live objects, including individual cells, sub-cellular organelles, and even individual molecules, with high level of detail and information content. Being until recently a privilege of large institutions and centralized facilities, live cell imaging systems are now spreading into small labs, while sophisticated high content imaging stations are being deployed to screening labs.

At the same time, the wide and ever increasing range of imaging techniques and applications necessitates regular updates for existing users as well as an up-to-date introduction and some general guidance for newcomers to this area. This volume of the *Methods in Molecular Biology* series provides a comprehensive compendium of experimental approaches to live cell imaging in the form of several overview chapters followed by representative examples and case studies covering different aspects of the methodology. The 21 chapters of this volume are prepared by leaders in these fields, and the outstanding contribution of the authors is gratefully acknowledged. The book provides a range of state-of-the-art protocols extensively validated in complex biological studies. It highlights new experimental and instrumental opportunities and helps researchers to select appropriate imaging methods for their specific biological questions and measurement tasks. Each method also highlights the potential challenges and experimental artefacts which are likely to appear and which unfortunately are still not very uncommon. We believe that this volume will contribute to the further development and dissemination of this fundamentally important technology which spans across many disciplines including molecular and cell biology, chemistry, physics, optics, engineering, cell physiology, and medicine.

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Live Cell Imaging

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