Preface

Fluorescence in situ Hybridization (FISH) belongs to that special category of well-established molecular biology techniques that, since their inception a few decades ago, have succeeded in keeping a prominent position within the constantly expanding list of laboratory procedures for biomedical research and clinical diagnostics.

The design simplicity and cost-effectiveness of the early FISH protocols, combined with the significant acceleration of discoveries in related technical areas such as fluorescence microscopy, digital imaging, and nucleic acid technology have prompted the diversification of the original technique into an outstanding number of imaginative and useful applications, and thus have not only held back its outmoding but have also promoted its expansion into different areas of basic and applied research in the post-genomic era.

The 34 chapters included in this book aim at portraying the vibrant complexity and diversity of the current FISH protocol landscape, providing cutting-edge examples of various applications for genetic and developmental research, cancer research, reproductive medicine, diagnostic and prognostic purposes, microbial ecology, and evolutionary studies. The book is divided in four parts: (I) Core Techniques, (II) Technical Advancements and Novel Adaptations, (III) Translational FISH: Applications for Human Genetics and Medicine, and (IV) Protocols for Model Organisms.

Part I brings together a comprehensive range of “foundation” protocols from well-established molecular cytogenetics and chromosome biology laboratories. The understanding of the theoretical and practical aspects of these core protocols should provide the beginners with a solid and inspiring introduction to the technique but should also function more widely as an updated and reliable groundwork reference for every person in the field. Protocols for notoriously challenging techniques such as RNA-FISH, Multiplex-FISH, and immunoFISH on chromatin fibers are included and explained in detail in Chaps. 3, 6, and 7, respectively. This section also includes newer applications of basic FISH on tissue microarrays and tissue sections in Chaps. 4 and 5, respectively.

The following three parts show how the original protocols have been aptly and deftly modified and/or applied to specific investigative purposes. More specifically, Part II brings together protocols that are particularly innovative such as COMET-FISH, the use of Quantum dots in FISH, CO-FISH, Cryo-FISH, and multicolor banding. Of particular note is the closing chapter (Chap. 17) describing an exciting new development that pushes the boundaries of FISH so far that FISH no longer needs to be performed on fixed material but can be elicited in living cells.

Part III focuses on the role of FISH and the future prospects in medical and clinical settings for genetic-based diagnostics and prognosis. This part starts with an important chapter (Chap. 18) that sets out how to ensure quality control in the laboratory and how important this is to clinical uses of FISH. The section further develops into the use of FISH in prenatal and pre-implantation diagnosis (Chaps. 19 and 20) and covers techniques for parental origin determination (Chap. 22), high-resolution CGH, and isolated nuclei from biopsy material. The last two chapters (Chaps. 25 and 26) describe a new way
of applying FISH in a 3D tissue culture model of tumor biology and a combined flow sorting/FISH protocol for HIV-1 disease monitoring.

Part IV focuses on the development of FISH for different model organisms, and this section transverses the animal kingdom, starting with Chap. 27 and FISH on bacteria, through yeast (Chap. 28) and Drosophila (Chap. 30) to mammals, especially 3D preserved in vitro constructed embryos (Chaps. 31 and 34).

The subdivision of chapters into four parts provides a framework for an ordered consultation of the book. However, this “vertical” organization is largely conventional and should not deter the readers from broadening their perspective by also consulting the book in a “horizontal” fashion, cross-referencing between different parts and comparing protocols and troubleshooting notes from a range of laboratories.

Coordinating the efforts of so many distinguished and resourceful investigators has been an honor, and editing this book has been a profoundly invigorating and uplifting experience. Once again, thank you all for your hard work and beautiful contributions.

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