

BOOK REVIEW

Imaging in Neuroscience and Development, A Laboratory Manual

Eds., Rafael Yuste, Arthur Konnerth, 854 pages+xvi, ISBN 0-87969-692-3, illus., appendices, index. Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York (2005), \$159.00 paperback.

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New developments in deep tissue imaging such as multiphoton excitation microscopy are having a significant impact on the fields of neuroscience and development. Not surprisingly, the Cold Spring Harbor Laboratory course "Imaging Structure and Function of the Nervous System" has gained great popularity over its 15-year history and has spawned not just one but two well-respected texts. The more recent, *Imaging in Neuroscience and Development, A Laboratory Manual*, is the new edition of *Imaging Neurons, A Laboratory Manual*, first published in 2000. The authors are course directors and thus well experienced to edit a laboratory manual on the subject.

Directed toward students and researchers whose work involves imaging in neuroscience, developmental biology, and cell biology, this new edition is designed for use at the setup or bench. The emphasis is on the practical techniques and procedures that are used to optically image a variety of preparations. The text is augmented with an extensive section on microscopy principles and instrumentation, which could serve the researcher who works in biological imaging. Since the majority of the chapters are composed of protocols, techniques, and detailed procedures, I think that this book can best be used as a laboratory manual to accompany an undergraduate or graduate course on optical imaging with emphasis on neurobiology and developmental biology. Therefore, I recommend this book as a laboratory manual and not as an independent textbook.

This new edition of *Imaging in Neuroscience and Development* has expanded coverage of applications in developmental biology. On the one hand, the editors opted to delete some useful chapters and appendices from the first edition. For example the useful chapter on two-photon cross sections of indicators was deleted as well as the glossary and the list of manufacturers and suppliers. However, this new version has more than 20 new chapters that describe techniques for imaging gene expression, quantum dots, hyperresolution microscopy, fluorescence resonance energy transfer (FRET), FCS, and FRAP. In addition, there are 40 very brief chapters on imaging techniques with specific applications.

The utility of many of these very brief chapters is questionable. There is a great disparity in the depth of coverage between the full-length chapters and the very brief chapters; I find that they are too brief to be useful in a laboratory manual.

The strengths of the full-length chapters are their balance of theory, instrumentation, and protocols, together with a very good analysis of errors, limitations, and pitfalls that severely degrade the specimen, the measurements, and the analysis and interpretation of the results and conclusions.

Some chapters in the new book are unchanged from the first edition in 2000, and some have only cosmetic alterations, i.e., a few references are changed. It is fair to state that many of the chapters from the first edition were not completely reworked and brought up to date by the authors. For example, the chapter on "Lasers for Multiphoton Microscopy" is unchanged from the first edition (2000). This is unfortunate since readers may come to this text seeking information on new devices, new techniques, and a critical and up-to-date survey of the literature.

Generally speaking, the book is suitable and highly recommended as a laboratory manual. The editors have years of experience and have produced a work that is a wonderful laboratory teaching manual. In conjunction with the text, the presence of instructors would insure that the procedures are correctly carried out and that the students are mindful of the cautions.

Through a judicious selection of topics and contributors who are true experts in modern optical imaging techniques and instruments, the editors have succeeded in providing an excellent background on optical imaging. For example, the chapter on "Microscopy and Microscope Systems" by Lanni and Keller serves to provide a very high level yet extremely clear exposition of the subject. These two experts on light microscopy begin their very comprehensive chapter with a section on the use and care of microscopes. They then proceed to discuss paraxial image formation, the Abbe model of resolution, Köhler illumination, various optical methods of contrast, the optical transfer function, Nyquist sampling, aberrations, and background light. They include a listing of internet sites, but that is unfortunately outdated and does not include the interactive tutorial on microscopy from Nikon and Florida State University.

Lanni contributed another excellent chapter on fluorescence grating imaging systems for optical sectioning microscopy. This chapter is based on the work from the Wilson group at Oxford. While it is a very clear discussion of the theory, technique, and disadvantages, it is not complete. For example the very important three-dimensional imaging technique called selective plane illumination microscopy (developed in the Stelzer laboratory at EMBO) is not included. Their 2004 paper in *Science* clearly demonstrated the utility of this technique for optical sectioning deep inside live embryos. Fortunately, the book contains an extensive chapter by Sharpe on optical projection tomography: Imaging 3-D organ shapes and gene expression patterns in whole vertebrate embryos. These two 3-D imaging techniques are related.

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There are chapters on lasers for multiphoton microscopy (unchanged from the 2000 edition), acousto-optic tunable filters, arc lamps and monochromators, liquid crystal tunable filters as well as appendices on lenses, filters, and emission/excitation spectra.

In order to fit 102 chapters, three appendices, and an index into a book that is of comparable size with other books in the series, the publishers have used a smaller font and decreased the interline spacing. This results in increased difficulty read-

ing the text and following the protocols in a laboratory setting. Except for this deficit, the production quality is very good; the figures (many in color) and line drawings are very sharp, and they augment the text. The book includes a comprehensive index as well.

In summary, *Imaging in Neuroscience and Development* is recommended as a useful laboratory manual. It would be helpful, however, if future editions would incorporate updates to **all** of the chapters.