# PREFACE

The familiar leaves us tranquil, but the unexpected makes us productive.

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Recently, two volumes of "Methods in Cell Biology" were devoted to biological electron microscopy. "Cellular Electron Microscopy" (Volume 79, edited by J. Richard McIntosh) covers specimen preparation, 3-D imaging, labeling of macromolecules, and technologies for data acquisition and analysis. "Introduction to Electron Microscopy for Biologists" (Volume 88, edited by Terry D. Allen) intends to give information to scientists who may be considering electron microscopy as a tool to extend molecular, biochemical, or light microscopical findings to the ultrastructural level. The reader might ask: Why is there a third MCB volume about electron microscopy within a rather short period of time? The reason is simple: "Electron Microscopy of Model Systems" approaches the subject from a different "angle". The primary goal of this volume is not to give an in-depth, systematic description, or introduction to techniques related to biological electron microscopy. In this book the methods are not the main focus. Here, the intent is to cover EM methods in the context of specific specimen preparation requirements for a particular model organism or system. Specific requirements differ a lot from model system to model system, and this is the challenge. "Electron Microscopy of Model Systems" is the first compendium covering the various aspects of sample preparation for very diverse biological systems. Comparing the different model systems, it is the differences in specimen preparation that make us "productive".

This book covers the preparation of unicellular organisms, invertebrate and vertebrate model systems, tissue samples, and cultured cells for electron microscopy. The list includes the most "traditional" or popular systems, such as budding (Buser) or fission yeast (Roque and Antony), the roundworm *Caenorhabditis elegans* (Müller-Reichert *et al.*), the fruitfly *Drosophila* (and other insects, Keil and Steinbrecht), the zebrafish (Schieber *et al.*), and the plant *Arabidopsis* (Kang). This volume, however, also covers the preparation of single cells and organisms that are less frequently used, such as archaea (Rachel *et al.*), *Chlamydomonas* (O'Toole), *Tetrahymena* (Giddings *et al.*), *Paramecium* (Hausmann and Allen), *Dictyostelium* (Koonce and Gräf), *Hydra* (Holstein *et al.*), flatworms (Salvenmoser *et al.*), and the Axolotl (Kurth *et al.*). Model systems of medical importance are also included, such as viruses (Laue), *Trypanosoma* (Höög and Gull), and *Plasmodium* (Hanssen *et al.*).

A set of chapters is devoted to the preparation of specific tissues such as cartilage and bone (Keene and Tufa), mouse (Moebius *et al.*), and rat tissues (Vanhecke *et al.*). Two chapters deal with the specifics of sample preparation for the cytoskeleton.

The different fixation requirements for actin (Resch *et al.*) and intermediate filaments (Kirmse *et al.*) nicely illustrate that the biological question "dictates" the selection of a specific method out of a repertoire of several techniques. Some systems are also included here because they are used for exemplary cell biology studies on abscission (Guizetti *et al.*), viral infection (Walther *et al.*), and intracellular transport (van Weering *et al.*). Last but not least, the advantages of 2-D versus 3-D cell culture (Hess *et al.*) and "Tips and Tricks" for high-pressure freezing are presented (McDonald *et al.*).

Finally, this book is also a reflection of an ongoing discussion in the field of biological electron microscopy. What is the best method of fixation? Some authors argue for the exclusive application of cryopreparation and imaging, while others emphasize the need for initial chemical fixation, or the requirement for inactivation of infectious material. Again, a decision for any of the methods presented here strongly depends on the biological question asked, the size of the biological system, and the practicality of the approach. The list of model systems presented here is by no means complete, but it is hoped that the models and techniques that are represented will help the reader to find appropriate methods for the preparation of her/his favorite system for electron microscopy.