Preface

Three-dimensional electron microscopy has opened a new window for observing cellular ultrastructure. Reconstruction in 3D can be applied to the full spectrum of biological material, ranging from whole model systems down to molecular assemblies in tissues and cells. It is the aim of this *Methods in Cell Biology* volume on "Three-Dimensional Electron Microscopy" to cover this full range of applications and to present currently available techniques for each scale of observation. The additional aim is to cover aspects of instrumentation, methods for specimen preparation, and also hardware and software issues. All of these aspects of 3D electron microscopy are covered in the context of specific applications.

For the analysis of relatively large areas and volumes, focused ion beam (FIB) and serial block face (SBF)-scanning electron microscopy (SEM) are presented. In addition, the automated tape-collecting ultramicrotome (ATUM) is covered as a means to use the SEM for large-scale reconstruction. For the tomographic reconstruction of relatively small volumes, transmission electron microscopy of samples embedded either in plastic or ice is presented. To increase the specimen thickness for electron tomography, the use of serial plastic sections and also scanning transmission electron tomography (STEM) is included. Last but not least, the use of software packages for tomographic data acquisition, computational approaches for image stitching and alignment of serial volumes, content-aware denoising of cryo-electron micrographs (CryoCARE) and subtomogram averaging are also covered in this book.

Certainly, this volume of *Methods in Cell Biology* cannot deal with all aspects and applications of 3D electron microscopy. The interested reader is therefore also referred to the detailed list of publications presented in each chapter. It is hoped that this volume will serve as a valuable source of information for the electron microscopy community dealing with 3D electron microscopy in diverse kinds of biological samples.

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Dresden, March 31, 2019