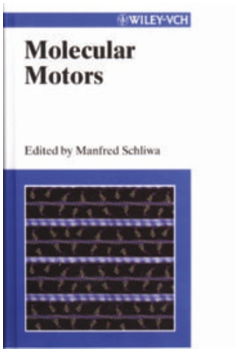
Motoring down the molecular highway



Molecular motors

Edited by Manfred Schliwa

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James R Sellers

Lately, the study of molecular motors has garnered considerable attention, given recent findings on their roles in cell division and development and their general amenability for single-molecule studies. Because motor studies bring together a multitude of disciplines, including crystallography, biophysics, single-molecule studies, biochemistry and cell biology, and because they are involved in so many different cellular and developmental processes, one would need an entire book to cover their functions. Indeed, this is just what we have in a new volume edited by Manfred Schliwa that is appropriately termed, *Molecular Motors*. Almost forty authors have contributed to the 23 chapters that formulate this book. The chapters are organized into five sections: basic principles of motor design, mechanochemistry, functional implications of motors, motors in disease and "beyond biological applications", which describes synthetic chemical-based motors. From these groupings it is clear that the book covers a wide spectrum of subjects, from single-molecule biophysics to the role of motor proteins in human disease. There is a little bit for everyone here, and readers who are specialists in one discipline will be able to explore new aspects of molecular motors to broaden their perspectives.The motors covered include myosins, kinesins, dyneins, helicases, polymerases, the F1-ATPase and bacterial flagella motors. There is even a chapter on artificial synthetic molecular motors built from organic molecules. Most of the standard molecular motors are covered in sufficient detail. Some chapters are devoted to a discussion of specific motors, whereas others focus on particular aspects of motors such as the role of motors in membrane trafficking or regulation of motor activity. My only serious complaint about the content is the lack of a chapter devoted to the structure and proposed mechanism of myosin action. The subject is briefly touched on in the chapter about quantitative measurements of myosin movement *in vitro*. However, this does not appear until midway through the book and only covers very basic information that has been gleaned from the study of myosin crystal structures and from site-directed mutagenesis of the molecule. Several excellent reviews have been written on this topic over the last few years and a stand-alone chapter on the mechanism of myosin's powerstroke similar to the chapter on the kinesin structures would have made the book even better.

Controversial subjects are treated in different ways in the book. In most cases, a single author is writing on the controversy and presenting both sides of the arguments. This is the case for discussions of both the processive one-headed kinesin KIF1A and the function of the bacterial flagellar motor. However, two separate chapters, one by Spudich and the other by Ishii and Yanagida, cover the contentious matter of myosin mechanochemistry. These chapters delve into the debate of whether myosin works through a tightly coupled lever arm model or whether a loosely coupled biased thermal Brownian motion accounts for the movement. Readers who are unfamiliar with this long-running debate in the myosin field may be confused by the different perspectives and the reader would probably have been better served had one voice presented the evidence on both sides of the argument. However, one benefit of the dual chapters is that there is a great deal of discussion about the novel high-tech approaches used to study the behavior of single molecules.

Most chapters are very up to date, with numerous references to work published in 2002, and should therefore serve as invaluable resources for students and researchers who are just moving into the field. However, because progress in many of the areas covered is proceeding at a brisk pace, readers who are working in the field will realize that in some cases major new papers have already appeared since the publication of the book. However, this is true of virtually any such book published these days.

As in any muti-authored volume there are inconsistencies in writing style and some redundancy in the content. For example, the structure of dynein is covered in various degrees of detail in three separate chapters, and the matter of directionality of kinesins is mentioned in several others. But in general, few will read this volume in a linear, cover-to-cover manner, and the redundancy will help orient the novice reader who is tackling only the subjects of immediate interest. Colourful, informative figures complement the text throughout the book and some chapters contain useful tables compiling properties of the various motors. The section on motors in disease will particularly benefit grant writers everywhere, as it provides references to convincing evidence that funding basic studies on molecular motors will contribute to long-term human health!

Although many of the chapters might be too detailed or assume too much prior knowledge for the average undergraduate, the book should be essential reading for graduate students in the field of cell motility and molecular motors. I had a great time reading it myself and recommend it enthusiastically for all others. □

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