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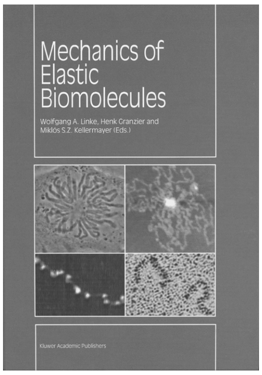
A Stretching and Relaxing Read

*Helen Hansma**



Mechanics of Elastic Biomolecules

Edited by
Wolfgang Linke, Henk Granzier
and Miklós Kellermeyer
Kluwer 2003, 236 pp.
ISBN 1-4020-1191-1
Hardcover, €145

This is a timely book, reflecting current interests in single-molecule biophysics and biomaterials. The book is a hard-bound volume reprinted from the *Journal of Muscle Research and Cell Motility* (Vol. 23(5–6), 2002) and is well illustrated with useful figures. It is good for both the novices and the specialists in these fields. The book is valuable for new-comers to the field, since it presents the mainstream research on the stretching of two major biomolecules—of DNA and of the giant muscle protein titin—in the form of diagrams of the experimental techniques graphs of the most significant results. The book is also valuable for specialists in the field, since it has a wealth of recent research results and covers a number of topics that are peripherally related the mainstream research in the field. For example, there is a section on invertebrate muscle proteins, introducing such molecules as twitchin in the worm *Caenorhabditis elegans* and projectin in insects. These articles are a useful complement to the section on titin, which contains research that is generally well known to specialists in the field. The comparative data on sequences and structures in muscle proteins are especially interesting, now that the many genome projects are yielding such a wealth of data, raising interest in the relationships between different organisms and the evolutionary changes from simpler to more complex organisms. The other sections of this book cover proteins of the cytoskeleton and the extracellular matrix.

The introduction gives a good justification and explanation for the material that is and is not included in the book. The book focuses, as its title says, on biomolecules. Therefore it does not cover work on synthetic or biomimetic molecules. It also does not cover work on larger biological structures—mesostructures or macroscopic structures—for which molecular mechanics are not known. Therefore there are no articles on spider silk, for example (although spider-silk research is now beginning to move into the molecular level).

There is overlap between articles in several cases. For example, the first two articles both present pulling curves for double-stranded (ds) and single-stranded DNA, and three of the five titin articles present diagrams and data for titin unfolding. This overlap actually serves at least three useful functions. First, it emphasizes the most important concepts and results in the major areas. Second, it serves as an internal control, such that the interested reader can find the details that differ in procedures and results among the work of different labs. Third, it provides the novice reader with a variety of presentations of the material.

Some chapters are stronger than others. The article by Linke and Fernandez, for example, has a beautiful and informative diagram of titin pulling, while one of the earlier articles in this section has a diagram that does not really communicate what happens when titin is pulled in an atomic force microscope (AFM).

I found many delightful nuggets in the book. The article on mitotic chromosomes by Poirier and Marko has clear models of possible chromosome substructure—specifically, the three-dimensional arrangement of the 30-nm chromatin fiber within the condensed chromosome—and data that supports one of these models. The favoured model is that ionic interactions—and the resulting electrostatic forces—pull the 30-nm fiber into a network in each chromatid of condensed mitotic chromosomes. It is amazing that there is still so much basic information to learn about chromosome substructures more than a century after chromosomes were first seen in the light microscope.

Among the many other delightful nuggets are the saw-tooth rupture peaks in filamin, a protein that crosslinks actin filaments, and an AFM image of a 41-bead-long molecule resembling a string of pearls. This molecule is a fibrillin-rich microfibril from the extracellular matrix. The book contains a wealth of data, such as the table of research articles on microfibril and elastic-associated molecules, the table on the history of AFM measurements of DNA, and the figures representing the various approaches to single-molecule biophysics. One of the best of these figures is in the article by Zlatanova and Leuba.

The interested reader will discover many other nuggets, such as the pH-dependent force and length changes in elastin and the different pulling curves for bare dsDNA and dsDNA in the presence of the intercalating carcinogen ethidium bromide or the DNA-binding protein RecA. The authors of the articles in this book include giants in both the experimental and theoretical aspects of biomolecular elasticity, such as Fernandez, Schulten, Urry, and others. The book has an attractive large-page format with glossy paper and an illustrated hard cover, which makes it enjoyable to browse and to study. Molecular biologists, biophysicists, and other scientists should all be able to learn from this book in an enjoyable way.

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