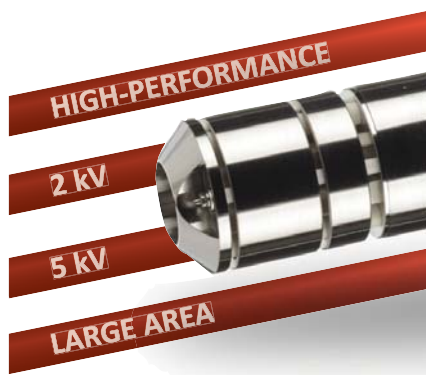


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propose that Bose–Einstein statistics could be adapted to describe atmospheric nucleation processes, and they present a new parameterization of heterogeneous ice nucleation. The inclusion of new, unreviewed work offers the possibility that some aspects of the text can move science forward significantly, but it also demands that readers carefully evaluate the novel aspects of the work, as they have not yet acquired the authoritative sheen of established science.

I highly recommend *Thermodynamics, Kinetics, and Microphysics of Clouds* for atmospheric science professionals and advanced students. Its combination of analytical rigor, up-to-date references, and equations adapted for modeling applications makes it a valuable resource for modelers and experimentalists in cloud physics and climate research. This important work will also challenge readers with its novel approach to the field and provide a fresh perspective that they have likely not encountered.

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polymer structures and solution characteristics by measuring diffusion coefficients and other transport properties. However, determining such governing properties as polymer size, shape, and intermolecular interactions from experimentally accessible transport phenomena is a nontrivial task that continues to attract the attention of theorists.

Due to the ubiquity of polymer solutions in biological systems and the mounting demand for new multifunctional materials that mimic those well-adapted biological fluids, an ever-growing number of scientists are working to understand the physics underlying biological soft matter. Researchers in that interdisciplinary endeavor often find themselves straddling the fields of polymer physics and biophysics without a true home in either. Thus, training the field's future researchers is a formidable task requiring courses and texts that are accessible to students from a range of disciplines and that merge critical concepts in polymer physics and molecular biophysics.

Himadri Bohidar's *Fundamentals of Polymer Physics and Molecular Biophysics* is the first text expressly designed for that purpose. Bohidar is chair of the Special Centre for Nanosciences at Jawaharlal Nehru University in New Delhi, India. He developed the text from his lecture notes for a graduate-level physics course, but his intended multidisciplinary audience includes students and experimentalists who have a minimal background in advanced mathematics and molecular biology. The mathematical content and Bohidar's terse style may make some aspects of the text inaccessible to the entire intended audience; however, most chapters conclude with a recap of the main points and some suggested exercises that nicely and accessibly summarize the key concepts of the chapter.

Fundamentals of Polymer Physics and Molecular Biophysics is divided into two sections. The first focuses on the physics of polymer solutions, and the second covers essential molecular biophysics concepts. Bohidar opens with a review of necessary thermodynamics and statistical mechanics and then reviews thermodynamic properties of solutions and phases.

The next several chapters

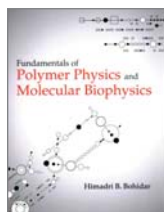
Fundamentals of Polymer Physics and Molecular Biophysics

Himadri B. Bohidar

Cambridge U. Press, 2015. \$110.00 (350 pp.).
ISBN 978-1-107-05870-5

Polymer solutions have captured the interest of researchers across disciplines, from physics and engineering to biology, chemistry, and materials science. Biopolymers, the building blocks of life, appear in such naturally occurring solutions as blood, mucus, and biological cells. Synthetic polymer solutions, found all around us, are essential to a range of industries, from cosmetics, food, and pharmaceuticals to athletics, construction, and defense.

Important and widely varying, those “soft” materials display intriguing non-Newtonian properties—such as viscoelasticity—that are tuned via the lengths, topologies, concentrations, and molecular interactions of the polymers in solution. Experimentalists endeavor to determine intrinsic



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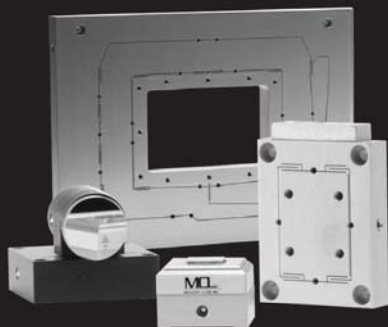
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unpack important polymer-physics concepts largely found in Masao Doi and Samuel Edwards's *The Theory of Polymer Dynamics* (Oxford University Press, 1986) and Pierre-Gilles de Gennes's *Scaling Concepts in Polymer Physics* (Cornell University Press, 1979). Bohidar discusses both static and transport properties in varying solvent conditions and concentrations: Essential static properties include radius of gyration, hydrodynamic radius, persistence length, and mesh size; transport phenomena of interest include diffusion, sedimentation, and viscosity. He also covers solvent conditions and concentration regimes, discussing excluded volume effects, blob theory, and the key dynamical models controlling different regimes: the Zimm, Rouse, and reptation models. Throughout the book, he emphasizes the universal scaling laws that connect experimentally accessible transport and configurational quantities to intrinsic molecular structure.

The latter half of the book introduces key concepts in molecular biophysics—for example, structural properties of nucleic acids, proteins, and polysaccharides. It also discusses protein charge, folding kinetics, helix-coil transitions, enzyme kinetics, DNA charge screening, and persistence length. Many of the same topics are also covered in Philip Nelson's *Biological Physics* (updated edition, W. H. Freeman, 2013). Bohidar closes with a “special topics” chapter that highlights two of his research interests: biopolymeric nanoparticles and coacervation (electrostatically driven liquid–liquid phase separation).

Important contemporary biopolymer problems Bohidar does not address relate to cytoskeleton polymers and networks—in particular actin, microtubules, intermediate filaments, and crosslinking proteins. Also missing is a discussion of single-molecule biophysics techniques, such as biopolymer tracking by fluorescence microscopy and spectroscopy and biopolymer manipulation and force measurements with optical tweezers. Macromolecular crowding is only briefly mentioned.

Bohidar's bibliography is thorough and includes many foundational polymer texts, including the aforementioned ones. Because his discussion of rheological properties is minimal, Bohidar omits such texts as Ronald Larson's *Constitutive Equations for Polymer*

Melts and Solutions (Butterworth, 1988).

Although I would like to have seen a more seamless integration of polymer physics and molecular biophysics, I still regard *Fundamentals of Polymer Physics and Molecular Biophysics* as an excellent first step to training future researchers in biological soft matter. I recommend it as a resource for advanced physics students interested in this new and exciting field or for professors wishing to teach a graduate-level course on the topic. The text is also a welcome and succinct

reference for experimentalists in this interdisciplinary field.

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