Atomic Force Microscopy For Biologists

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Cell Imaging Techniques World Scientific Publishing Company
Recent advances in imaging technology reveal, in real time and great detail, critical changes in living cells and organisms. This manual is a compendium of emerging techniques, organized into two parts: specific methods such as fluorescent labeling, and delivery and detection of labeled molecules in cells; and experimental approaches ranging from the detection of single molecules to the study of dynamic processes in organelles, organs, and whole animals. Although presented primarily as a laboratory manual, the book includes introductory and background material and could be used as a textbook in advanced courses. It also includes a DVD containing movies of living cells in action, created by investigators using the imaging techniques discussed in the book. The editors, David Spector and Robert Goldman, whose previous book was Cells: A Laboratory Manual,are highly respected investigators who have taught microscopy courses at Cold Spring Harbor Laboratory, the Marine Biology Laboratory at Woods Hole, and Northwestern University.
Intermolecular and Surface Forces Princeton University Press
Atomic force microscopy (AFM) is an amazing technique that allies a versatile methodology (it allows the imaging of samples in liquid, vacuum or air) to imaging with unprecedented resolution. But it goes one step further than conventional microscopic techniques; it also allows us to make measurements of magnetic, electrical or mechanical properties of the widest possible range of samples, with nanometre resolution. This book will demystify AFM for the reader, making it easy to understand, and easy to use. Peter Eaton and Paul West share a common passion for atomic force microscopy. However, they have very different perspectives on the technique. Over the past 12 years Peter used AFMs as the focal point of his research in a variety of scientific projects from materials science to biology. Paul, on the other hand, is an instrument builder and has spent the past 25 years creating these microscopes for scientists and engineers. This insightful book covers the theory, practice and applications of atomic force microscopes and will serve as an introduction to AFM for scientists and engineers that want to learn about this powerful technique, and as a reference book for expert AFM users. Application examples from the physical, materials, and life sciences, nanotechnology and industry illustrate the many and varied capabilities of the technique.
High-Speed Atomic Force Microscopy in Biology Academic Press
The second volume of the series Manuals in Biomedical Research, this book is aimed to be both a concise introduction to the diverse field of microscopy and a practical guide those who require the use of microscopic for methods in their research. It provides young as well as experienced scientists a state-of-the-art multidisciplinary overview of microscopic techniques, covering all the major microscopy fields in biomedical sciences and showing their application in evaluating samples ranging from molecules to cells and tissues.Microscopy has revolutionized our understanding of biological events. Within the last two decades, microscopic techniques have provided insights into the dynamics of biological processes that regulate such events. Biological discovery, to a large extent, depends on advances in imaging techniques and various microscopic techniques have emerged as central and indispensable tools in the biomedical sciences.The four authors bring with them extensive experiences spanning across disciplines such as Microbiology, Molecular and Cell Biology, Tissue Engineering, Biomedical and Regenerative Medicine and so forth, reinforcing the fact that microscopy has proven useful in countless investigations into the mysteries of life.
Nanoscale Imaging John Wiley & Sons
Geared towards research scientists in structural and molecular biology, biochemistry, and biophysics, this manual will be useful to all who are interested in observing, manipulating and elucidating the molecular mechanisms and discrete properties of macromolecules.
Atomic Force Microscopy in Molecular and Cell Biology Springer Nature
Macromolecules; Interfacial systems; ordered macromoleculles; Cells, tissue and biominerals; STM; SNOM; SICM; SThM; PFM.
Atomic Force Microscopy CSHL Press
SPECTROSCOPY FOR MATERIALS CHARACTERIZATION Learn foundational and advanced spectroscopy techniques from leading researchers in physics, chemistry, surface science, and nanoscience In Spectroscopy for Materials Characterization, accomplished researcher Simonpietro Agnello delivers a practical and accessible compilation of various spectroscopy techniques taught and used to today. The book offers a wide-ranging approach taught by leading researchers working in physics, chemistry, surface science, and nanoscience. It is ideal for both new students and advanced researchers studying and working with spectroscopy. Topics such as confocal and two photon spectroscopy, as well as infrared absorption and Raman and micro-Raman spectroscopy, are discussed, as are thermally stimulated luminescence and spectroscopic studies of radiation effects on optical materials. Each chapter includes a basic introduction to the theory necessary to understand a specific technique, details about the characteristic instrumental features and apparatuses used, including tips for the appropriate arrangement of a typical experiment, and a reproducible case study that shows the discussed techniques used in a real laboratory. Readers will benefit from the inclusion of: Complete and practical case studies at the conclusion of each chapter to highlight the concepts and techniques discussed in the material Citations of additional resources ideal for further study A thorough introduction to the basic aspects of radiation matter interaction in the visible-ultraviolet range and the fundamentals of absorption and emission A rigorous exploration of time resolved spectroscopy at the nanosecond and femtosecond intervals Perfect for Master and Ph.D. students and researchers in physics, chemistry, engineering, and biology, Spectroscopy for Materials Characterization will also earn a place in the libraries of materials science researchers and students seeking a one-stop reference to basic and advanced spectroscopy techniques.
Molecular Manipulation with Atomic Force Microscopy Academic Press
Life scientists believe that life is driven, directed, and shaped by biomolecules working on their own or in concert. It is only in the last few decades that technological breakthroughs in sensitive fluorescence microscopy and single-molecule manipulation techniques have made it possible to observe and manipulate single biomolecules and measure their individual properties. The methodologies presented in Single Molecule Techniques: Methods and Protocols are being applied more and more to the study of biologically relevant molecules, such as DNA, DNA-binding proteins, and motor proteins, and are becoming commonplace in molecular biophysics, biochemistry, and molecular and cell biology. The aim of Single Molecule Techniques: Methods and Protocols is to provide a broad overview of single-molecule approaches applied to biomolecules on the basis of clear and concise protocols, including a solid introduction to the most widely used single-molecule techniques, such as optical tweezers, single-molecule fluorescence tools, atomic force microscopy, magnetic tweezers, and tethered particle motion. Written in the highly successful Methods in Molecular BiologyTM series format, chapters contain introductions to their respective topics, lists of the necessary materials and reagents, step-by-step, readily reproducible laboratory protocols, and notes on troubleshooting and avoiding known pitfalls. Authoritative and accessible, Single Molecule Techniques: Methods and Protocols serves as an ideal guide to scientists of all backgrounds and provides a broad and thorough overview of the exciting and still-emerging field of single-molecule biology.
Atomic Force Microscopy/Scanning Tunneling Microscopy Cambridge University Press
With the invention of scanning probe techniques in the early 1980s, scientists can now play with single atoms, single molecules, and even single bonds. Force, dynamics, and function

can now be probed at the single-molecule level. Molecular Manipulation with Atomic Force Microscopy (AFM) presents a series of topics that discuss concepts and methodol
Spectroscopy for Materials Characterization John Wiley & Sons
The atomic force microscope (AFM) has become one of the leading nanoscale measurement techniques for materials science since its creation in the 1980's, but has been gaining popularity in a seemingly unrelated field of science: biology. The AFM naturally lends itself to investigating the topological surfaces of biological objects, from whole cells to protein particulates, and can also be used to determine physical properties such as Young's modulus, stiffness, molecular bond strength, surface friction, and many more. One of the most important reasons for the rise of biological AFM is that you can measure materials within a physiologically relevant environment (i.e. liquids). This book is a collection of works beginning with an introduction to the AFM along with techniques and methods of sample preparation. Then the book displays current research covering subjects ranging from nano-particulates, proteins, DNA, viruses, cellular structures, and the characterization of living cells.
Correlative Imaging John Wiley & Sons
Intermolecular and Surface Forces describes the role of various intermolecular and interparticle forces in determining the properties of simple systems such as gases, liquids and solids, with a special focus on more complex colloidal, polymeric and biological systems. The book provides a thorough foundation in theories and concepts of intermolecular forces, allowing researchers and students to recognize which forces are important in any particular system, as well as how to control these forces. This third edition is expanded into three sections and contains five new chapters over the previous edition. - Starts from the basics and builds up to more complex systems - Covers all aspects of intermolecular and interparticle forces both at the fundamental and applied levels - Multidisciplinary approach: bringing together and unifying phenomena from different fields - This new edition has an expanded Part III and new chapters on non-equilibrium (dynamic) interactions, and tribology (friction forces)
Force Microscopy Springer Science & Business Media
A diverse collection of state-of-the-art methods for the microscopic imaging of cells and molecules. The authors cover a wide spectrum of complimentary techniques, including such methods as fluorescence microscopy, electron microscopy, atomic force microscopy, and laser scanning cytometry. Additional readily reproducible protocols on confocal scanning laser microscopy, quantitative computer-assisted image analysis, laser-capture microdissection, microarray image scanning, near-field scanning optical microscopy, and reflection contrast microscopy round out this eclectic collection of cutting-edge imaging techniques now available. The authors also discuss preparative methods for particles and cells by transmission electron microscopy.
Atomic Force Microscopy Springer
Atomic force microscopy (AFM) is part of a range of emerging microscopic methods for biologists which offer the magnification range of both the light and electron microscope, but allow imaging under the 'natural' conditions usually associated with the light microscope. To biologists, AFM offers the prospect of high resolution images of biological material, images of molecules and their interactions even under physiological conditions, and the study of molecular processes in living systems. This book provides a realistic appreciation of the advantages and limitations of the technique and the present and future potential for improving the understanding of biological systems.The second edition of this bestseller has been updated to describe the latest developments in this exciting field, including a brand new chapter on force spectroscopy. The dramatic developments of AFM over the past ten years from a simple imaging tool to the multi-faceted, nano-manipulating technique that it is today are conveyed in a lively and informative narrative, which provides essential reading for students and experienced researchers alike./a
Methods in Cellular Imaging IntechOpen
The book addresses new achievements in AFM instruments – e.g. higher speed and higher resolution – and how AFM is being combined with other new methods like NSOM, STED, STORM, PALM, and Raman. This book explores the latest advances in atomic force microscopy and related techniques in molecular and cell biology. Atomic force microscopy (AFM) can be used to detect the superstructures of the cell membrane, cell morphology, cell skeletons and their mechanical properties. Opening up new fields of in-situ dynamic study for living cells, enzymatic reactions, fibril growth and biomedical research, these combined techniques will yield valuable new insights into molecule and cell biology. This book offers a valuable resource for students and researchers in the fields of biochemistry, cell research and chemistry etc.
Atomic Force Microscopy in Process Engineering Springer Science & Business Media
STM and SFM in Biology is a book fully dedicated to biological applications of the new technology of scanning probe microscopy (SX). The scanning tunneling microscope (STM) and its first off-spring, the scanning force microscope (SFM), resolve surface topography at the atomic scale. They also detect certain electronic and mechanical properties, and perform well in ultrahigh vacuum, ambient atmosphere, and aqueous solution environments. Thus, STM and SFM offer powerful tools for biological investigations of nucleic acids, proteins, membranes, and living cells. - Introduces the reader to SXM - Presents fundamentals of STM, SFM, and other SXMs - Covers biological applications of STM and SFM - Describes experimental techniques that can be reproduced in the laboratory - Contains extended bibliographies that guide the reader to detailed source publications
Nano Comes to Life Springer Science & Business Media
This first book on high-speed atomic force microscopy (HS-AFM) is intended for students and biologists who want to use HS-AFM in their research. It provides straightforward explanations of the principle and techniques of AFM and HS-AFM. Numerous examples of HS-AFM studies on proteins demonstrate how to apply this new form of microscopy to specific biological problems. Several precautions for successful imaging and the preparation of cantilever tips and substrate surfaces will greatly benefit first-time users of HS-AFM. In turn, the instrumentation techniques detailed in Chapter 4 can be skipped, but will be useful for engineers and scientists who want to develop the next generation of high-speed scanning probe microscopes for biology. The book is intended to facilitate the first-time use of this new technique, and to inspire students and researchers to tackle their own specific biological problems by directly observing dynamic events occurring in the nanoscopic world. Microscopy in biology has recently entered a new era with the advent of high-speed atomic force microscopy (HS-AFM). Unlike optical microscopy, electron microscopy, and conventional slow AFM, it allows us to directly observe biological molecules in physiological environments. Molecular “movies” created using HS-AFM can directly reveal how molecules behave and operate, without the need for subsequent complex analyses and roundabout interpretations. It also allows us to directly monitor morphological change in live cells, and dynamic molecular events occurring on the surfaces of living bacteria and intracellular organelles. As HS-AFM instruments were recently commercialized, in the near future HS-AFM is expected to become a common tool in biology, and will enhance and accelerate our understanding of biological phenomena.
Atomic Force Microscopy in Liquid Humana Press
This book features reviews by leading experts on the methods and applications of modern forms of microscopy. The recent awards of Nobel Prizes awarded for super-resolution optical microscopy and cryo-electron microscopy have demonstrated the rich scientific opportunities for research in novel microscopies. Earlier Nobel Prizes for electron microscopy (the instrument itself and applications to biology), scanning probe microscopy and holography are a reminder of the central role of microscopy in modern science, from the study of nanostructures in materials science, physics and chemistry to structural biology. Separate chapters are devoted to confocal, fluorescent and related novel optical microscopies, coherent diffractive imaging, scanning probe microscopy, transmission electron microscopy in all its modes from aberration corrected and analytical to in-situ and time-resolved, low energy electron microscopy, photoelectron microscopy, cryo-electron microscopy in biology, and also ion microscopy. In addition to serving as an essential reference for researchers and teachers in the fields such as materials science, condensed matter physics, solid-state chemistry, structural biology and the molecular sciences generally, the Springer Handbook of Microscopy is a unified, coherent and pedagogically attractive text for advanced students who need an authoritative yet accessible guide to the science and practice of microscopy.
Atomic Force Microscopy/Scanning Tunneling Microscopy CRC Press
This is the first book to bring together both the basic theory and proven process engineering practice of AFM. It is presented in a way that is accessible and valuable to practising engineers as well as to those who are improving their AFM skills and knowledge, and to researchers who are developing new products and solutions using AFM. The book takes a rigorous and practical approach that ensures it is directly applicable to process engineering problems. Fundamentals and techniques are concisely described, while specific benefits for process engineering are clearly defined and illustrated. Key content includes: particle-particle, and particle-bubble interactions; characterization of membrane surfaces; the development of fouling resistant membranes; nanoscale pharmaceutical analysis; nanoengineering for cellular sensing; polymers on surfaces; micro and nanoscale rheometry. - Atomic force microscopy (AFM) is an important tool for process engineers and scientists as it enables improved processes and products - The only book dealing with the theory and practical applications of atomic force microscopy in process engineering - Provides best-practice guidance and experience on using AFM for process and product improvement
Atomic Force Microscopy CRC Press
Advances in technology have revolutionized the development of light microscopy techniques in biomedical research, thus improving visualization of the microstructure of cells and tissues under physiological conditions. Fluorescence microscopy methods are non-contact and non-invasive and provide high spatial and temporal resolution that other laboratory techniques cannot. This well-illustrated book targets graduate students and scientists who are new to the state-of-the-art fluorescence microscopy techniques used in biological and clinical imaging. It explains basic concepts and imaging procedures for wide-field, confocal, multiphoton excitation, fluorescence resonance energy transfer (FRET), lifetime imaging (FLIM), spectral imaging, fluorescence recovery after photobleaching (FRAP), optical tweezers, total internal reflection, high spatial resolution atomic force microscopy (AFM), and bioluminescence imaging for gene expression. The usage of these techniques in various biological applications, including calcium, pH, membrane potential, mitochondrial signaling, protein-protein interactions under various physiological conditions, and deep tissue imaging, is clearly presented. The authors describe the approaches to selecting epifluorescence microscopy, the detectors, and the image acquisition and processing software for different biological applications. Step-by-step directions on preparing different digital formats for light microscopy images on websites are also provided.
Atomic Force Microscopy Investigations into Biology Oxford University Press
Atomic force microscopes are very important tools for the advancement of science and technology. This book provides an introduction to the microscopes so that scientists and engineers can learn both how to use them, and what they can do.
Bioimaging Academic Press
Scope of the Book Synthetic and natural polymers exhibit a complex structural and morphological hierarchy on multiple length scales [1], which determines their performance. Thus, research aiming at visualizing structure and morphology using a multitude of microscopy techniques has received considerable attention since the early days of polymer science and technology. Various well-developed techniques such as optical microscopy and different forms of electron microscopy (Scanning Electron Micr- copy, SEM; Transmission Electron Microscopy, TEM; Environmental Scanning Electron Microscopy, ESEM) allow one to view polymeric structure at different levels of magni?cation. These classical techniques, and their applications to po- mers, are well documented in the literature [2, 3]. The invention of Scanning Tunneling Microscopy (STM) inspired the devel- ment of Atomic Force Microscopy (AFM) and other forms of scanning proximity microscopes in the late 1980s [4, 5]. AFM, unlike STM, can be used to image n- conducting specimens such as polymers. In addition, AFM imaging is feasible in liquids, which has several advantages. Using liquid imaging cells the forces between specimen and AFM probe are drastically reduced, thus sample damage is prevented. In addition, the use of water as imaging medium opened up new applications aiming at imaging, characterizing, and analyzing biologically important systems.

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