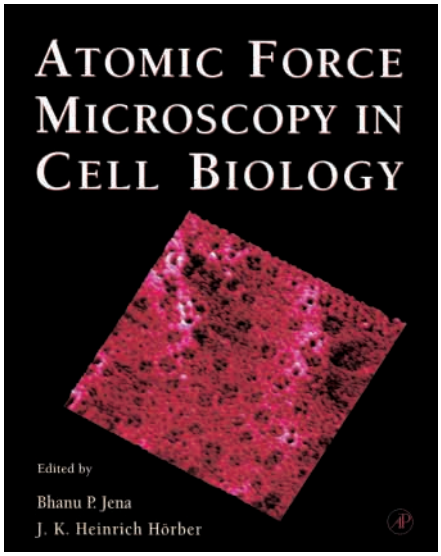
Feeling our way around biomolecules



Methods in Cell Biology, Vol. 68: Atomic Force Microscopy in Cell Biology

edited by Bhanu P. Jena and J. K. Heinrich Hörber

Academic Press (2002) 415 pages. ISBN 0-12-383851-7
$89.95

To most biologists the atomic force microscope (AFM) is still an exotic instrument. Invented in 1986, it is one of a family of scanning-probe microscopes that produce images by monitoring the deflections produced as the tip of a tiny probe is drawn back and forth across a specimen mounted on a suitable substrate. The AFM was originally developed for use in the physical sciences, where its ability to produce images of exquisitely high resolution (down to the Ångstrom range) soon led to its appearance in many laboratories. Biologists who had seen these instruments were attracted to the high resolution, and, perhaps even more so, to the possibility that images of very small cellular and subcellular features might be obtainable in near-physiological conditions. As a result, throughout the 1990s AFMs became established in a few, rather enlightened, biological laboratories across the world.

Once installed in a biological laboratory, other nearby biologists heard about the AFM and, perhaps spurred on by their curiosity at the instrument's grandiose name, came along with various cells and macromolecules for examination. In general, at first there tends to be disappointment. The reasoning is, perhaps, that surely something called an 'atomic force microscope' must fully occupy a reasonably large room and look something like a microscope? The AFM fails on both these counts. Commercial instruments are about 30 cm high, sit on top of a bench or table without being obtrusive and look nothing like either an optical or electron microscope. Often, however, the disappointment in the lack of grandeur is rapidly superseded by the excitement at the images that can be produced (not quite down to the Ångstrom level in biological specimens, but certainly in the nanometre range) and so, over the past decade or so, more and more biologists, working on a wide range of systems, have used the AFM to complement other experimental techniques. Importantly, until a few years ago, nobody had ever used an AFM to study biological specimens and so techniques to make cells and macromolecules amenable to study using the AFM have had to be developed from scratch.

Atomic Force Microscopy in Cell Biology has contributions from a number of scientists, from both biological and non-biological laboratories, and gathers together their particular areas of expertise. They have used the AFM to solve various problems and have often exploited its capabilities in novel and ingenious ways. All the chapters are informative on techniques for the successful preparation of experimental material. Topics covered range from imaging the surfaces of intact cells to examining interactions between single, purified macromolecules and structural studies on macromolecules in two-dimensional arrays or artificial lipid bilayers. New refinements of AFM techniques, such as 'Q control' (by which the quality of images can be enhanced by electronic compensation for interaction forces experienced between the AFM tip and the sample under examination), are covered and, importantly, are explained in a way that should not engender apprehension or 'techno-fear' in an AFM novice.

Of key importance are the chapters in which methods that exploit the non-imaging potentials of the instrument are described. Broadly speaking, these focus on the AFM's ability to measure interaction forces between tip and specimen or to exert force on a specimen. This means that the AFM can be used to measure the forces required to produce conformational changes in proteins, and (in a refinement that seems to recruit more and more protagonists by the month) tips can be functionalised with ligands that interact with features, such as receptors, on cell surfaces. By measuring forces of interaction as the ligand-coated tip is scanned over the surface of a cell, a map of the distribution of receptors can be produced.

A further group of chapters describe a more recent development from the AFM – namely the Photonic Force Microscope (an instrument that uses optical tweezers to produce a novel type of scanning probe microscope) – and also the combination of AFM simultaneously with other techniques, such as confocal laser microscopy and patch-clamp recording, with a resulting synergy of results.

Atomic Force Microscopy in Cell Biology is a good, readable and timely book. It will prove a good starting point for any cell biologist embarking on experiments with the AFM and will undoubtedly prove useful to those already in the field.

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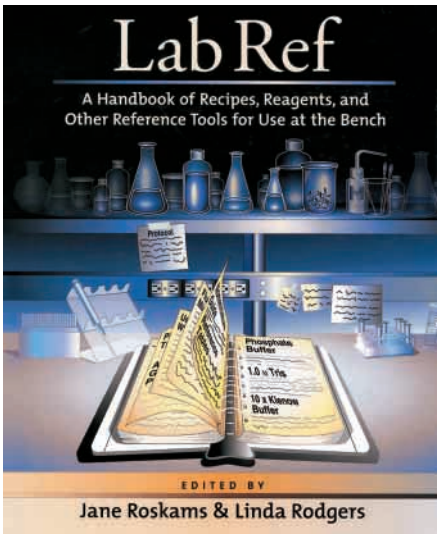
Lab Ref: a recipe for every occasion



Lab Ref: A Handbook of Recipes, Reagents, and Other Reference Tools for Use at the Bench

edited by Jane Roskams and Linda Rodgers

Cold Spring Harbor Laboratory Press (2002) 272 pages. ISBN 0-87969-630-3
$24.95

Let me start by saying this is not the sort of book you try and read cover to cover. Nor would I recommend such an attempt, noble though it may be. This is not how the book is supposed to be used. The simple fact is that the editors set out to produce a handy bench-top reference source of the reagents needed for a variety of Cold Spring Harbor manuals and that is exactly what they have achieved. Herein lies both the strengths and weaknesses of this particular book. A handy reference manual needs to be small and easy to access, and this book fills these criteria well. To the editors' credit each section is well indexed, although, personally, I thought the inclusion of attachable tags with the book, to allow the user to mark commonly referred to pages, would have been an asset. On the plus side, the blank 'notes' pages are a nice feature.

Unfortunately the book has some weaknesses that I feel detract from the package. Some of these faults are not to do with the book itself but rather with this genre as a whole. Within Section One the editors describe how to make simple stock solutions (including 1 M calcium chloride and 10 mg/ml ethidium bromide); however, the way that they go about this does not encourage me to buy the book. Why? Because I believe that simply spoon-feeding individuals with 'add x grams of chemical y to 1 litre of water' in no way enhances their skills base. Sure there is a short-term gain as it speeds up the making of a simple solution; however, there are no long-term gains, nor will it help them to achieve their potential. Furthermore, any seasoned investigator who needs to be told how to make a 10% (w/v) SDS solution or a 10 mg/ml ethidium bromide solution needs to brush up on their basic skills! The value of the short-term gains verses the long term is a question for each individual to ask themselves when they consider buying this book.

As one of my colleagues said, "it is the 'why' which is important", and the editors have attempted to address this with fragments of useful and interesting information throughout the manual. However, this does not alleviate the fact that *Lab Ref* is essentially a compendium of recipes, and although the editors cross-reference to manuals, there is no cross-referencing to actual methods. Mind you, having said that, the logistics and usefulness of such an epic undertaking would be questionable.

Section Seven (Useful facts and tables) was the section that I, personally, found the most interesting, although the usefulness of the some of the information might be queried. The biggest problem with this section derived from the organisation of the tables within Section 7a, which lacked any obvious formal subdivisions – a minor oversight perhaps? Similarly, there were problems with the list of "Useful World Wide Web sites" – for example, the exclusion of the *Saccharomyces* genome database was glaringly obvious to me. However, when compiling these types of list it is all but impossible to satisfy everyone. In contrast, the nomenclature guide, while brief, was well organised and could prove useful to those of us who forget the correct way to annotate a gene when discussing an organism other than our own particular model.

I feel that *Lab Ref* is useful if you don't have access to the original Cold Spring Harbor manuals from which the methods were taken. In these circumstances, paying $24.95 for a single book that alleviates the requirement to find the original manual is a small price to pay for peace of mind.

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