Can’t clone, won’t clone

Essential Molecular Biology, Vol. 1, 2nd edn
edited by T. A. Brown
£29.95

I have heard it said (though not to my face) that practical molecular biology is somewhat akin to cookery, and I have to admit (though not to my fellow Molecular Biologists) that there is an element of truth in this. Of course, our ovens are cooler, and our pie dishes smaller, but often it is a case of mixing ingredients in the right proportions and baking at 37°C for an hour.

In this book Brown becomes the Delia Smith of molecular biology, starting with how to boil an egg, before proceeding to more complex recipes. It is utterly and unashamedly aimed at the complete novice. As more and more branches of biology use molecular techniques, and as a constant flow of graduates take up the yoke of research, there will always be a demand for this type of manual. Of course, it is possible to find variants of a lot of these methods on the Internet, but, as these often include only the protocol, the complete novice is probably better off with a specifically designed manual. Another option is to go for the kit approach, but, in the same way as opening a tin of beans doesn’t make you a chef, I wholeheartedly agree with Brown when he says, ‘do not get the idea that using kits is the same as being a molecular biologist.’ In most branches of biology a bit of genuine molecular expertise can only enhance one’s future job prospects!

One of the things I liked about this book is its no-nonsense style, particularly those chapters written by the Editor. There is plenty of sound advice, not just on the molecular techniques but on how to be a good scientist in general. Although the advice starts with the basics, it isn’t patronising to those experienced in other fields. One piece of advice that particularly tickled me was that, if your hand is too unsteady to load a gel, you should give up caffeine; I’m not sure whether the pain would be worth the gain!

The first chapter deals with all the basic issues, from planning (not just how to do it, but is it worthy of your time, which is something we should all think about occasionally) to safety (which nasties you’ll be using, what precautions to take, with internet sites referenced to fill in the details) and what equipment you’ll need to run the experiments. In a nutshell, the rest of the book deals with microbiology for molecular biologists and molecular biology for everyone else. This includes DNA and RNA isolation, electrophoresis and cloning (generating, propagating and identifying recombinant DNA molecules, not the Dolly-the-sheep variety). There is a second volume to the set, which (based on the contents of the first edition) should cover making and screening libraries, the polymerase chain reaction, sequencing and gene expression studies. Bear in mind that to get very far you will need to buy the second volume, which is not yet published.

It has been more than a decade since the first edition of this well-known and respected manual was published; so one would think its first update is about due. However, compared with the first edition, most chapters have very few changes. This is probably in the nature of such a basic manual - for example, good microbial practice doesn’t change much. Only a couple of chapters have been extensively rewritten; those describing DNA extraction now include more recent resin-based methods.

So to the crux of the matter: would I recommend buying it? Well, if you’re a complete novice with little backup, I definitely think it is worth investing in a decent manual, and this one does have a nice comfortable feel to it. If you’ve already got a copy of the previous edition and are wondering whether to upgrade, I would say that the few improvements in these very basic techniques do not really make it worth spending the £30 that this volume costs. That said, I rather suspect that the second volume, which deals with more complex techniques, will show far more technical advances and should complete your progression from culinary incompetence to cordon bleu.

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The cytoplasmic fate of mRNA

Translational Control of Gene Expression
edited by N. Sonenberg, J. W. B. Hershey and M. B. Matthews
US$115

At the beginning of the 90s most molecular biologists were focusing on transcription and RNA splicing, mRNA translation and its temporal and spatial regulation seemed research topics for insiders at that time. However, all aspects of mRNA fate in the cytoplasm will certainly attract much more attention during the next decade. The field is now flourishing with connections to all disciplines of biology. This book will help you to realize the tremendous variation of translational regulatory mechanisms existing in nature. The evidence for their importance has become so overwhelming that nobody seriously interested in gene expression can ignore it any longer. It is the great merit of the editors of this book that they have brought together an impressive
series of first-class reviews written by the most prominent scientists in the field.

The new monograph takes a fresh look at the field and is greatly expanded compared with the earlier 1996 version. The book is judiciously divided into two parts. The first part comprises eight broad chapters, giving an overview of the main principles of protein synthesis and its regulation. They serve as a thorough basis for the second part, which comprises twenty-eight chapters, each about 20 pages in length, that present in depth additional exciting areas in which there is strong research activity. Your appetite for this book will be stimulated right at the beginning by the wonderful introductory chapter, which is written jointly by the editors and defines the field in its entire complexity. Given that translation is of course a unifying principle of all living organisms, why are there such a large number of different control mechanisms modulating the use of mRNA templates and making actual protein level not predictable from RNA quantity alone? Are these just remnants of an RNA world or, as the authors seem to believe, effective adaptations for fine-tuning gene expression that have been opportunistically added during evolution?

Five broad chapters are devoted to our knowledge of initiation, elongation and termination of translation both in eukaryotes and in prokaryotes. It is amazing how much detail has been added, in just the past five years, to our picture of the biochemistry, structure and function of ribosomes, initiation sites, and translation factors. However, translational control of gene expression is not just a matter of the translation machinery alone. It seems rather that the tremendously versatile mRNA sequences and structures impose the way they are seen by the translation apparatus and its factors. Particularly in eukaryotes, the untranslated parts of mRNAs play a decisive role by providing additional interaction sites for cytoplasmic proteins that modulate mRNA stability, mRNA localization or accessibility of mRNAs to translation. In turn, many of the proteins interacting with mRNA are themselves regulated by metabolites or post-translational modifications. This is beautifully documented in an exciting chapter on the role of translational control in developmental decisions. For example, in Drosophila, a specific cascade of factors acting on RNA localization and translation controls the anterior-posterior body axis. In C. elegans, the fate of germ-line cells is determined by translational repression. And you will find many more such examples.

Another important section of the book is devoted to changes in translation that occur during virus infection. Again one is amazed by the variety of ways by which viruses divert the host translation apparatus for their own sake. The shorter chapters give insight into additional exciting areas in the field. For example, research into how heat shock or signal transduction pathways feed into translation, what we know about mRNA degradation of normal and nonsense-containing transcripts, and the evidence that local synaptic protein synthesis represents a molecular hallmark of learning and memory.

This book is the most complete and up-to-date review of translational control mechanisms. It is a must for students entering the field, and it will constitute for many years a major reference guide for any investigator who is seriously interested in the full picture of gene expression.

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A nuclear tale of two yeasts

The Yeast Nucleus
edited by P. Fantes and J. Beggs
£32.50

Without question, numerous studies in yeast and mammals have revealed a striking commonality of underlying mechanisms that govern basic biological operations. Perhaps the most famous example from recent years has been the recognition that genes required for maintaining the yeast genome play a critical role in preventing cancer in humans. However, examining the molecular differences - the variations on a common theme, so to speak - can also be useful for understanding core biological processes. These ideas are the foundation for The Yeast Nucleus, a valuable contribution to Oxford University Press’s ‘Frontiers in Molecular Biology’ series. The textbook compares and contrasts various nuclear processes in budding yeast (Saccharomyces cerevisiae) and fission yeast (Schizosaccharomyces pombe), pointing out the similarities - and differences - that make these two somewhat unrelated yeasts the dominant model systems for studying fundamental eukaryotic processes.

Each of the nine chapters is an authoritative review written by experts in the field. The opening chapter surveys the technologies that have propelled efforts to elucidate the functions of the ~6000 predicted protein-encoding genes in S. cerevisiae; this chapter includes sections on bioinformatics, genomewide transcription and proteome analysis. The next four chapters - covering DNA replication, the mitotic cell cycle, cell cycle checkpoints and nuclear division - form a well-integrated quartet that describes the complex molecular and genetic pathways governing faithful chromosome replication and segregation. The cell cycle
chapter, in particular, is presented from a unique perspective: rather than focusing on the physiological changes that occur at each stage, it instead illustrates the molecular machines (i.e., the cyclin-dependent kinases) that propel the cell cycle. The fifth chapter provides a comprehensive discussion on RNA polymerase II transcription in S. cerevisiae that incorporates sections on general transcription factors, coactivators and repressors. It also includes a brief synopsis of the effects of chromatin on transcription, which creates a nice segue to the following chapter on the structure of chromatin at centromeres and telomeres. The final two chapters, on pre-mRNA splicing and nuclear transport of RNA and proteins, focus mainly on the mechanisms identified in budding yeast. The only obvious shortcoming with respect to the scope of this textbook is that it fails to include in-depth discussions of DNA repair and recombination.

This publication has several attributes that make it an excellent reference source. First, it is a comprehensive review that weaves a great deal of supplementary information into each chapter. It not only is extensively referenced, but also frequently includes citations to reviews and to yeast database websites for further details. Second, the book is well written and readable. Each chapter is organized in a logical sequence - for example, the chapter on DNA replication starts with origin recognition and ends with Okazaki fragment processing. Furthermore, although the descriptions of genetic and molecular pathways are often encyclopedic, extensive summary tables and/or simple diagrams supplement the discussions and assist the reader in grasping the information. The value of such summary tables can be greatly appreciated when navigating through the maelstrom of mismatched S. cerevisiae and S. pombe CDC and RAD gene nomenclature. Lastly, there is an overall congruity that pulls together the topics of the separate chapters and relates them to one another. For instance, examples of genome-wide analyses are highlighted in several chapters to convey the practicality and usefulness of this approach, and the chapters on splicing and nuclear transport both include small sections that link these activities to other nuclear processes that have been discussed. It is important to note, however, that a complete understanding of many of the sections will require prior knowledge of fundamental genetic principles and molecular biology techniques; for this reason, the book may be better suited to the more advanced reader.

The Yeast Nucleus is designed to stimulate thinking - not only about the similarities and differences between the budding and fission yeasts, but about whether comparable mechanisms might be used in other organisms as well. To achieve this goal, it goes beyond a comparative analysis of the two yeasts, and draws parallels with bacteriophage, viral and a variety of metazoan systems when applicable. The result is a well-integrated view that succeeds in providing a foundation for provoking thought about the unity of basic biological mechanisms. Moreover, each chapter concludes with an insightful look at the future direction of the field. In these regards, this publication will serve as a fabulous guidebook for experts as well as students.

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Errata

From Stem Cells to Space Shuttles.


In a recent Book Review of Developmental Biology (6th edn) by S. F. Gilbert, and Developmental Biology - A Guide for Experimental Study (2nd edn) by M. S. Tyler, the publisher was incorrectly cited as W. H. Freeman. The correct publisher is Sinauer Associates.

Differential regulation of CENP-A and histone H3 phosphorylation in G2/M.


The second initial of the last author was omitted. The correct name should have been cited as Kevin F. Sullivan.

Commentaries

JCS Commentaries highlight and critically discuss recent exciting work that will interest those working in cell biology, molecular biology, genetics and related disciplines. These short reviews are commissioned from leading figures in the field and are subject to rigorous peer-review and in-house editorial appraisal. Each issue of the journal contains at least two Commentaries. JCS thus provides readers with more than fifty Commentaries over the year, which cover the complete spectrum of cell science.

Although we discourage submission of unsolicited Commentaries to the journal, ideas for future articles – in the form of a short proposal and some key references – are welcome and should be sent to the Executive Editor at the address below.

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