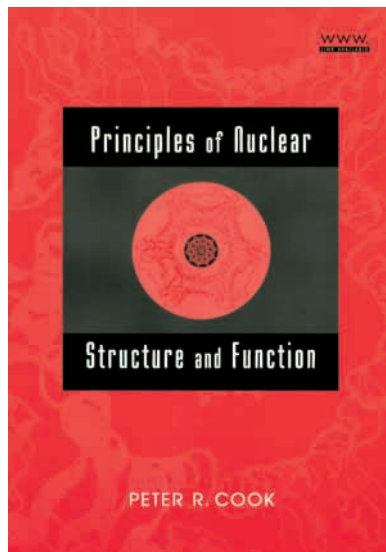


The essential nucleus



Principles of Nuclear Structure and Function

by Peter R. Cook

Wiley-Liss (2001) 352 pages. ISBN 0-471-41538-3
£57.50

Reading the popular press these days one could mistakenly think that, with the sequencing of the human genome, most important questions in biology have been answered. But, as with most interesting science, these breakthroughs are merely a starting point to address even more challenging and complex problems. Maybe the most fundamental current questions regarding genomes are how are genomes organized in a cell nucleus and how are genes actually expressed inside a cell? Although cell biological studies of the nucleus have a long tradition, there are remarkably large gaps in our understanding of gene and genome function in vivo. Even more remarkable is the fact that there has been no definitive textbook on nuclear structure and function. *Principles of Nuclear Structure and Function* by Peter Cook now fills this void - and it does it thoroughly and profoundly.

The critical feature that makes this book a success is the discussion of nuclear processes in the context of nuclear structure. Events such as transcription or replication are not, like so often, reduced to simple processes that occur in a test tube, but they are put in their

biological context as the complex events that they really are. The obvious, and often ignored, fact that they do not take place isolated from other biological events is at the heart of *Principles of Nuclear Structure and Function*.

Appropriately, the book starts out with an introduction to basic structural principles of cellular architecture, covering concepts such as scale, local concentrations, making of large structures and tensegrity. These are basic concepts that are often used or implied in cell biology, but it is rare to find a good description of them in the literature. The second chapter then applies these basic principles to the cell nucleus. Topics such as packaging of chromatin, chromosome territories and nuclear skeletons are discussed. These two chapters not only are a brilliant introduction for students, for whom this book is primarily written, but also serve seasoned 'nucleists' as a refresher on fundamental cell biological concepts and as a source of information on the basics of nuclear processes.

It is particularly laudable that Cook was not deterred from including numbers - in fact, lots of numbers - in his text. Numbers are often underappreciated in cell biology. Who knows how abundant one's favorite protein is or how many transcripts of one's favorite genes are present in a cell? As cell biology is increasingly merging with biophysics, numbers will become more and more important for cell biologists. Cook knows his numbers, and he uses them cleverly to convey the message that the nucleus is a complex structure and that by considering quantitative information we can gain fundamental insights into the inner workings of cells.

Following the introductory chapters, the major nuclear processes are discussed against the structural background provided in the early parts. These chapters cover replication, transcription, repair, gene regulation, the cell cycle and meiosis/recombination. While the latter two chapters are somewhat weaker, each covers its subject in depth. These chapters deal with the major nuclear functions, although others, such as rRNA processing or pre-mRNA

splicing, are only mentioned in passing. It is also somewhat surprising that more space was not devoted to nuclear bodies, which represent the most obvious manifestation of nuclear structure.

Cook strongly promotes his view that transcription and replication sites are immobilized in the nucleus, which represents an alternative to the more commonly accepted postulate that polymerases move along their templates. This could be a serious problem, but the way the arguments pertaining to this issue are presented highlights one of the assets of this book. While most textbooks do not give the reader much choice and simply state how things are, *Principles of Nuclear Structure and Function* does not patronize, but rather equips the reader with information to evaluate various possibilities. Most importantly, it provokes critical thinking on the reader's part. A feat only few textbooks accomplish.

Cook's writing is clear, light and at times colloquial, but always exquisitely accurate. The sequence of his arguments is logical and simple. The text is broken down into short subheaded sections, and important concepts and techniques are explained in separate boxes. The references are carefully chosen and their number is pleasingly small, although a list of additional reading material, which is periodically updated, is available online. All these features make this book easy to read and the subject approachable. Those of us who have heard Peter Cook lecture, will distinctly hear him speak as they read this book. I occasionally found myself nodding my head or smiling as I was reading.

Peter Cook has written an important book. A book that many have been waiting for and a book that many, not just those interested in the cell nucleus, should read. The book provides the basic concepts and tools to understand the cell nucleus, and it captures much of the essence of the nucleus as we understand it today. It is an essential book.

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A hitchhiker's guide to development



Essential Developmental Biology

by Jonathan Slack

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£16.50

Developmental biology is not one of the easiest of subjects to study. The richness in diversity of body forms and the surprising contortions embryos often go through to produce them (aspects of the subject that lure many into the field), make it especially hard for someone new to get a good handle on what is going on. Added to the complicated embryological interactions is the ever-increasing number of genes (often with confusing names) that are being identified as key players in these processes and whose products function through complex interactions with other gene products. Textbooks on developmental biology have the challenging task of presenting this subject to students in an engaging and clear manner. They have to strike a balance, presenting sufficient detail to be informative but not so much that they are confusing and the fundamental principles are lost in a sea of detail.

By these criteria, the book *Essential Developmental Biology* succeeds admirably. It is aimed at students at the undergraduate level and is intended to give a good grounding in the principles and experimental approaches of developmental biology. It does not try to be an exhaustive treatment of the subject,

but sets out to explain the central themes of development through a few well-chosen model organisms and systems. The book is eminently readable, written in a straightforward and easy-to-understand style. The numerous figures - line drawings, uncluttered and consistent in style - are clear and effectively illustrate the point being made. Perhaps my only quibble about the book is that at times it is too descriptive, cataloging what is known about a particular developmental process instead of conveying a sense of the debates and changing opinions in the field.

The text is divided into three broad sections. The first introduces general aspects of development that are useful in understanding the two subsequent sections. The second describes the development of a selection of model organisms, and the last section deals with organogenesis and regeneration.

The first section begins with a brief introductory chapter that describes the origin of developmental biology, the centrality of the subject to other fields of biology and its relevance to, and impact on, society. The remainder of the section follows a logical progression, starting with a chapter that describes the basic questions in development, and going on in other chapters to touch upon processes common to the development of most organisms, such as gametogenesis, fertilization, inductive interactions and morphogenetic movements during early embryogenesis. There is a chapter devoted to some of the molecular pathways that play important roles during development. One feature students will find especially useful is an appendix to this chapter, describing families of four categories of molecule especially important to development - transcription factors, inducing factors, cell adhesion molecules and extracellular matrix components. This appendix serves as a quick reference and will prevent students from being overwhelmed by the increasing numbers of molecules being discovered to function during development. There is a chapter on genetic techniques used in the study of development, such as mutagenesis and transgenesis, and a separate one on other more general techniques, such as microscopy, cell labeling, in situ hybridization, etc.

The second section is devoted to six model organisms - *Xenopus laevis*, the zebrafish, the chick, the mouse, *Drosophila melanogaster* and *Caenorhabditis elegans*. The introductory chapter in this section compares the various model organisms so that one gets a feel for their advantages and disadvantages (in terms of amenability to physical and genetic manipulation, cost, etc.) and can understand why someone might choose to work on one particular organism rather than another. Each of the subsequent chapters in this section focuses on one of the model organisms. Each begins with a fairly comprehensive, yet concise, overview of the early development of that organism. This is followed, in most cases, by a description of some of the major insights into development to arise from work in that organism. The chapter on flies, for example, describes the interactions of the gap, pair rule and segment polarity genes in the establishment of anterior-posterior pattern, whereas the chapter on frogs highlights in some detail the molecular interactions thus far known to be important for dorsoventral patterning and inductive interactions.

The last section of the book is devoted to the development of a few organ systems and regeneration. The first chapter in this section provides background information about various tissue types. The following chapters deal with the development of the nervous system, mesodermal organs (such as the kidney, gonads and limbs), imaginal discs in flies and regeneration in planarians and vertebrates. These chapters effectively use the development of these various organs to illustrate underlying developmental processes and the genetic pathways that control them.

Overall, I think this is a very good introductory text for developmental biology. It is clear, concise, and does a fairly good job of explaining a difficult subject. The book, true to its title, nicely presents the essentials required for a student to traverse the rough terrain of development.

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