BOOK REVIEWS

Intracellular Structures

Microtubules. JEREMY S. HYAMS and CLIVE W. LLOYD, Eds. Wiley-Liss, New York, 1994. xii, 439 pp., illus. $89.95 or £74. Modern Cell Biology, vol. 13.

First described with the aid of electron microscopy about 30 years ago, microtubules play critical roles in intracellular organization, organelle transport, ciliary and flagellar motility, and chromosome motion during mitosis. The book on the subject edited by Hyams and Lloyd—not the first with its title—covers the most recent advances in what is now a rapidly expanding field.

Though some contributions will be of interest primarily to researchers concerned specifically with microtubules, most of the volume will be of interest to a larger audience of cellular, molecular, and developmental biologists. For example, a contribution by Elizabeth Raff describes the results of experiments designed to elucidate the role of multiple genes for the subunit protein of microtubules, tubulin. The results reveal that not all tubulin genes are functionally interchangeable. Although the research clearly deals with the particulars of tubulin, it has implications for the larger questions of protein structure-function relationships and the evolution of multigene families. Several chapters address the topic of microtubule-associated proteins, in particular those found in neuronal tissue (contributions by Matus, Muller *et al.*, and Goedert *et al.*). Here again basic cellular questions are addressed: targeting of proteins to specific subcellular locations as well as the regulation of gene expression and the role of the cytoskeleton during neuronal development.

Several contributions are devoted to "molecular motors," enzymes that utilize the energy of adenosine triphosphate hydrolysis to move various cargoes along microtubule tracks. Analysis of the mechanism of force generation has itself made many advances of late, and the book is already out-of-date on this important topic. The contributions address the cellular regulation of motor molecules and the identity of the various cargoes that are transported. These topics should be of interest to those concerned with the general problem of organelle transport and membrane trafficking in eukaryotic cells.

The last chapter of the book deals with perhaps the most enticing aspect of microtubule biology, mitosis. Many are familiar with the general features of mitosis—the alignment of the chromosomes into the characteristic metaphase plate and the dramatic motion of the chromosomes to the spindle poles at anaphase. Movies of the process of mitosis never fail to enthrall viewers, seasoned veterans and newcomers alike. This chapter makes clear that many of the topics examined in previous chapters contribute to various aspects of mitosis as well. For example, cytoplasmic dynein and kinesin-like proteins are now known by genetic and immunological evidence to contribute to mitosis. Microtubule-associated proteins, gamma tubulin, and microtubule dynamic behavior, each discussed in earlier chapters, must also be accounted for in a complete description of mitosis. But despite many advances mitosis still remains incompletely understood, perhaps because it does involve so many interrelated processes. For example, McIntosh presents several models for spindle formation and notes that they are "slightly bewildering, not because one cannot see how spindle poles could separate or what enzyme could do the job, but because these are so many legitimate scenarios involving different motors." Later, in the context of anaphase motion, the complexity issue again surfaces: "Anaphase A is . . . a multicomponent process that probably involves minus motor activity at the kinetochores, plus motor activity at the poles, and tubulin depolymerization at both kinetochores and poles." In mitosis research it is difficult to eliminate any process, and, as McIntosh puts it, "We are faced with an embarrassment of possibilities with which to account for the observed movements." Perhaps analysis of the function of microtubules in simpler motility phenomena will help to shed some light on the more complex process of mitosis.

From among the vast quantity of interesting data available, the editors have made reasonable choices of what to include, bringing together information touching on central aspects of microtubules and their behavior in cells. The book will be especially useful for graduate and postdoctoral students who desire a readable overview of many topics pertaining to microtubules. Given the complexity of the issues, it seems likely that this will not be the last book on this interesting subject.

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Other Books of Interest

Mechanisms of Protein Folding. ROGER H. PAIN, Ed. IRL (Oxford University Press), New York, 1994. xviii, 265 pp., illus. $68 or £40; paper, $43 or £25. Frontiers in Molecular Biology.

"To be biologically active, proteins must adopt specific folded three-dimensional, tertiary structures. Yet the genetic information for the protein specifies only the primary structure, the linear sequence of amino acids in the polypeptide backbone. Many purified proteins can spontaneously refold *in vitro* after being completely unfolded, so the three-dimensional structure must be determined by the primary structure. How this occurs has come to be known as 'the protein folding problem.'" Thomas Creighton thus states the theme of this book intended to make the subject more accessible to a broad scientific audience. According to the editor, who points out that understanding protein folding is now not only "one of the most intriguing intellectual challenges in molecular biology" but an industrial necessity, "the main emphasis has been on surveying the concepts and experimental approaches that have led to our present knowledge of how proteins fold." Creighton's opening chapter analyzes the problem in a way intended to set the stage for the eight following contributions on more specific aspects of the subject. In chapter 2 Heinrich Roder and Gülnur Elöve describe the early stages of protein folding. Henriette Christensen and Pain then discuss the molten globule model, Barry Nall discusses proline isomerization as a rate-limiting step, and H. F. Gilbert discusses the formation of native disulfide bonds. The protein engineering approach (in which denatured proteins are induced to refold) to the analysis of folding is expounded by Andreas Matouschek *et al.* and Nicholas Price discusses the assembly of multi-subunit structures. Protein folding in vivo is described by Roman Hlodan and F. Ulrich Hartl, who consider the process in relation to biosynthesis, enzyme catalysis, and molecular chaperone proteins, and the final chapter, by David Thatcher and Antony Hitchcock, discusses "refolding science"

as practiced in the biotechnology industry. Each chapter has its own reference list, with some items flagged as recommended for further reading, and the book includes a list of abbreviations used and a subject index.

Katherine Livingston

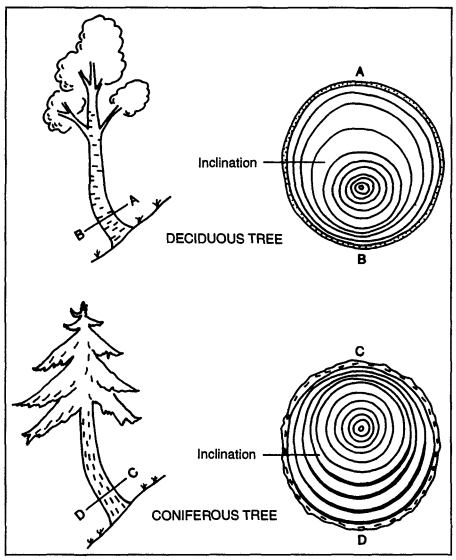
Aotus. The Owl Monkey. JANET F. BAER, RICHARD E. WELLER, and IBULAIMU KAKOMA, Eds. Academic Press, San Diego, CA, 1994. xx, 380 pp., illus. $74.95 or £58.

The South American owl monkey, or douroucouli, is, as described by Susan Ford in the first chapter of this book, "a somewhat small, monogamous, generally quadrupedal platyrrhine lacking a prehensile tail [and] is unique among anthropoids in its nocturnal habits." Though there is a considerable scientific literature on these monkeys stemming from their use in biomedical research, there has heretofore, according to the editors, been no comprehensive overview of the genus. Ford's chapter initiates this effort with a 57-page discussion of the taxonomy and distribution of *Aotus*; its members, once thought to be of a single species, occur in forest habitats at various altitudes throughout tropical South America; division into as many as nine species has recently been proposed, but after reviewing various kinds of evidence Ford finds support for no more than seven. In a chapter on fieldwork and conservation Rolando Aquino and Filomeno Encarnación review population densities, procedures for "harvesting" the animals, population structure, and selection of sleeping sites and report on the conservation status of the various species, which face threats due to deforestation, subsistence hunting, and trade. Patricia Wright gives an overview of *Aotus* behavior and ecology with particular attention to adaptations to a nocturnal life-style, and Allen Dixon reports on reproductive biology, from testicular and ovarian function to parenting behavior. Maintenance of the animals in captivity is the subject of the next two chapters, with Janet Baer giving an overview of husbandry and medical management, Carlos Málaga describing procedures for hand-rearing, and Richard Weller reviewing infectious and noninfectious diseases to which the monkeys are subject; the last of these chapters is complemented by a later one by Manuel Tantaleán and Alfonso Gozalo on parasitic infections. Laboratory studies using *Aotus* as a model are the focus of the remaining chapters in the book. In recent decades owl monkeys have been used in efforts to develop therapies for human malaria and in studies of viral oncogenesis, and these studies are described by William E. Collins and Norval King respectively. The relatively large eye and pupil of *Aotus* have made it a convenient model in ophthalmologic research, and Thomas Ogden summarizes what has been learned and concludes by recommending that, given its scarcity, further use of *Aotus* in this sphere be limited to cases where there is no alternative model. Thanks to their less fissured cortex neurobiology is another area in which owl monkeys have been extensively used, and studies on functional cortical organization generally and on the visual cortex in particular are summarized by Jon Kaas and by John Allman *et al.* The volume also includes a foreword by Primo Arambulo III of the Pan American Health Organization and a subject index.

Katherine Livingston

Dating in Exposed and Surface Contexts. CHARLOTTE BECK, Ed. University of New Mexico Press, Albuquerque, 1994. ix, 239 pp., illus. $45.

A problem common to the fields of archeology and geomorphology is that contamination of materials of interest due to exposure often makes the application of standard chronometric methods inappropriate—a problem compounded, as Beck notes in her introduction to this work, by the need not just to date particular materials but to establish chronologies over a broad landscape or to approach events of interest by way of their association with other events. It has thus been necessary for researchers in those fields to adapt existing methods or devise new ones. The purpose of this book is "to present a number of [the resulting] methods in systematic detail, while demonstrating their successful use in the dating of the surface artifact record and exposed features of the natural landscape." Beck's introductory exposition of the general issues is followed by nine more specific papers, each with an abstract and its own reference list. The first two contributions are primarily geological. In one P. L. K. Knuepfer describes the use of rock weathering rinds (zones of oxidation or hydration parallel to clast surfaces) to estimate ages of coarse-grained surfaces, and in the next D. McCarroll describes the use of the Schmidt hammer, a hand-held instrument designed to measure the surface hardness of concrete, for assessing rock surface weathering in a variety of terrains. More specifically of archeological concern is an account by Beck and G. T. Jones, reporting on data from Butte Valley, Nevada, of the application of obsidian hydration dating to sort out temporally mixed assemblages of artifacts. Efforts are being made to utilize rock varnish, an often biogenic coating that accretes in dry environments, to the dating of horizontally distributed materials, and these are described by Ronald Dorn. R. C. Dunnell and J. K. Feathers present an argument, drawing on their work in the central Mississippi Valley, for an expanded role for thermoluminescence dating in archeology, especially in surficial contexts. The use of cosmogenic nuclides, which now can be measured in smaller concentrations owing to the development of accelerator mass spectrometry, is the subject of two papers, an overview by M. D. Kurz and E. J. Brook and a discussion of the use of chlorine-36 by M. G. Zreda and F. M. Phillips. Biological evidence pertaining to age is the subject of the two final papers. J. A. Matthews, reporting especially on work in Norway, reviews lichenometric dating, a method based on lichen growth rates and primarily used in arctic or alpine environments, where lichen growth is relatively undisturbed by competition from other vegetation, for dating moraine ridges on recently deglaciated terrain, and O. Heikkinin gives an account of the use of dendrochronology for dating land surfaces. A brief index is included at the end of the volume.



"The inclination of trees can be dated from the tree rings, which become eccentric after tilting. The eccentricity of inclined coniferous trees is the opposite of that of deciduous ones." [From Heikkinin's paper in *Dating in Exposed and Surface Contexts*]

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