

laboratory involved in human genetic disease and in mutagenesis generally.

ANN C. CHANDLEY
MRC Human Genetics Unit,
Western General Hospital,
Edinburgh EH4 2XU

DNA Topology and Its Biological Effects, Monograph 20. Edited by NICHOLAS R. COZZARELLI and JAMES C. WANG. Cold Spring Harbor Laboratory 1990. 480 pages. Price \$97. ISBN 0 87969 348 7.

This book is the newest addition to the high quality series of monographs published by the Cold Spring Harbor Press and is no exception to this standard. The first half of the book deals with DNA structure and supercoiling and the second half with the enzymes that change its topology, the topoisomerases, and their effects. The subject area is central to the understanding of almost all DNA interactions (e.g. transcription, replication, recombination and chromosome organization) a pivotal role that is underlined by the effectiveness of topoisomerase inhibitors as anti-cancer drugs. The chapters are written by widely respected experts in the field and the book as a whole constitutes a welcome resource for many whose work impinges upon this area and a window into a marvellous world of coils and supercoils for anyone who just finds this subject fascinating. In the preface, the editors state that 'The organisation of this volume was designed to provide a structured introduction to the uninitiated ... and that the authors had been asked to write their chapters 'in a didactic style, operating on the assumption that the average reader would have little prior knowledge of the subject'. This is rather a tall order when also attempting to make each chapter 'a separate unit for the more advanced' in an area as intellectually challenging as this. From my point of view as a geneticist with an interest in this area I was interested to see how well they had succeeded in their goals and this review can be viewed as 'a geneticist's perspective'.

The book starts by introducing the structures of DNA, emphasising the knowledge that we now have from a variety of methods of the effect of sequence on structure. I found this section fascinating but not easy to follow and I would have appreciated a more gentle introduction to the definitions of twist, roll and slide at an earlier stage in the first chapter. The book then goes on to discuss the bending of DNA in nucleoprotein complexes and in loops that regulate gene expression. These chapters interweave the experimental evidence with theoretical work and illustrate the subject with examples to produce a clear picture. The only part that I had difficulty with was the 'linking number paradox' which was clarified in the later chapter on the topology and geometry of DNA supercoiling. To my mind, the chapter dealing with the topology and geometry of DNA supercoiling was

the high point of the book. This chapter takes the novice through the intricacies of linking number, twist and writhe to newer parameters such as surface twist and surface linking number without assuming any prior knowledge or advanced mathematical skills. I do not want to imply that the chapter makes for easy reading; it is very challenging. But to retain rigour while making the subject accessible is a superb achievement; congratulations. Unfortunately I cannot say the same thing about the chapter on DNA supercoiling and unusual structures. Here the theoretical treatment is not accessible without specialist knowledge outwith the coverage of the book, and the treatment of the experimental work on cruciforms and Z DNA is rather limited. The chapters of the book that cover the topoisomerases are more descriptive and therefore not so intellectually challenging. Type-I and Type-II topoisomerases of prokaryotic, eukaryotic, archeobacterial and viral origin are described in eloquent detail as are their effects on replication and illegitimate recombination; and the book ends with a section on the natural modification of topoisomerases and the effects of drugs that interact with topoisomerases and their use in the treatment of cancer. An appendix giving the nucleic acid and encoded amino acid sequences of topoisomerase genes completes the picture.

As a whole I believe that the book succeeds very well and will allow the non-specialist to enter into the world of coils and supercoils but also does not sacrifice the rigour required to be of value to the scientist working in this area. Because of my own interests I would have liked to have seen a section on site-specific recombination where such remarkable applications of topological principles have been made to understand the organisational level of the reaction mechanisms. But as the editors say in the preface they have not been 'exempted from the usual perils associated with the publication of a book on a rapidly evolving subject'. In fact they have done remarkably well in avoiding these perils and have put together a book that I can recommend very highly.

DAVID LEACH
Institute of Cell and Molecular Biology,
University of Edinburgh,
Mayfield Road, Edinburgh EH9 3JR

In Situ Hybridisation: Application to Developmental Biology and Medicine. Society for Experimental Biology Seminars Series 40. Edited by N. HARRIS and D. G. WILKINSON. Cambridge University Press. 1990. 288 pages. Hardbound Price £35.00. ISBN 0 521 38062 6.

This volume presents 14 articles based on talks given at a meeting on 'In situ hybridization' in Edinburgh in April, 1989. In situ hybridization uses labelled nucleic acid probes to detect specific RNA or DNA sequences within chromosomes, cells and tissues. This powerful

technique can be applied to an immense range of biological and medical problems, from mapping genes on chromosomes to sexing unborn children, from investigating gene expression to diagnosing viral infection in man. Given the breadth of this range, the dual aims of the book are ambitious: first to review progress in the application of the technique, and second to provide the would-be user with protocols and an appreciation of the technical options.

The first three chapters introduce the technique. Chapter 1, by G. Coulton, is a simple exposition of theory and practice with emphasis on non-radioactive methods. Chapter 2, by A. K. Raap *et al.* is an excellent review of the use of fluorescent probes. The third chapter, by A. Giaid *et al.*, complements the first by describing the use of radioactively labelled RNA molecules as probes and describes, as an example, the detection of peptide mRNA in the diffuse neuroendocrine system. All three chapters have good bibliographies while chapters 1 and 3 have example protocols with sufficient detail to allow anyone familiar with histology and molecular biology to use the technique. The content is a little patchy and displays some careless proofreading – for example, the effect of high salt concentration is to raise, not lower, the *T_m* (chapter 1) – but these three chapters together adequately describe the basic technique.

The remainder of the book is a series of specialized articles on the application of the technique to a wide range of problems. In general, the authors aim to combine a review of data, usually from their own group, with a description of technique (often with detailed protocols) in a way which illustrates the use of *in situ* hybridization for a particular purpose. The degree to which this aim is satisfied by properly balancing these different elements varies greatly between chapters. In this respect, the book would have benefited from closer editorial control.

Chapters 4–7 describe the use of *in situ* hybridization to investigate gene expression in animal development. R. C. Angerer *et al.* describe the patterns of gene expression during sea urchin development in a rather densely written review of the work of their group over the last decade. H. Perry-O'Keefe *et al.* describe adaptations of the technique required to detect mRNA in *Xenopus* oocytes, but give a rather poor account of their recent results. D. G. Wilkinson's contribution is of more general interest since it points out how *in situ* hybridization may reveal unexpected roles in mouse development for genes initially associated with cell proliferation in tumours or *in vitro*. Wilkinson discusses the implications for the use of the technique to identify developmentally important genes. However, by far the best chapter in this group is one by P. W. Ingham *et al.* who point out the limitations of *in situ* hybridization and show how the technique, applied to *Drosophila* development, provides the most biologically meaningful results when used in combination with other approaches which illuminate gene

function, for example the analysis of mutant phenotypes.

The first of the chapters (8–11) dealing with botanical applications is a different example of a good read. G. I. McFadden demonstrates, rather beautifully, the use of *in situ* hybridization at the electron microscope level to characterise the nucleic acids of the plastids in cryptomonad algae and *Chlorarachnion* and thus to provide evidence for their origin from eukaryotic endosymbionts. All the plant chapters are well written, S. Y. Wright and A. J. Greenland on the expression of male-specific flower genes in maize, N. Harris *et al.* on tissue preparation techniques for studies of the expression of storage-protein genes in peas, and K. G. Jones *et al.* on the use of resin-embedded tissue for high-resolution analysis of gene expression during gametogenesis. The latter three chapters provide detailed protocols for *in situ* hybridization on plant materials at the light, and electron, microscope levels. Jones *et al.* give a method for *in situ* nick translation on EM sections used to detect low levels of organellar DNA; curiously, this interesting technique is not mentioned in the otherwise good index.

The last three chapters deal with medical applications. The excellent article by J. D. West on the use of sex-chromosome specific probes to determine the sex of the human conceptus is well illustrated, rigorous, and useful in everything from the most general considerations to the fine details of technique. The chapter gives detailed protocols for *in situ* hybridization to chromosomes, interphase nuclei, and decondensed sperm heads and for double labelling techniques (using fluorescent and radioactive probes). The chapter by C. S. Herrington, *et al.*, on non-radioactive *in situ* hybridization in human pathology deals mainly with virus detection, but touches on applications in cytogenetics. This chapter has a good bibliography, but otherwise is rather disappointing. It is repetitious and in places quite misleading; for example, there is an amazing statement that ³H is inadequate as a label for resolution at the cellular level because the emissions have a track length of 1 mm in water (in fact, around 2 μm). This is another instance of inadequate editing. The final chapter, by M. Wells on the demonstration of viral DNA (papilloma, cytomegalovirus, JC and EB virus) in human tissues is more brief and to the point and contains useful protocols for non-radioactive methods including immunogold staining.

This is a book worth knowing about, particularly for the chapters by Ingham *et al.*, and by West, and for the botanical chapters. Is it a book worth buying? As a techniques manual it is adequate, though not complete. For example, there is no real description of oligonucleotide probes, *in situ* hybridization on cells in suspension, quantitative *in situ* hybridization, or methods for visualizing and recording signal and no consideration of possible approaches to very rapid

methods which will be necessary for some potential medical applications. These are aspects of the technique that will surely be important in the next few years. Alternative technical books would be *In situ Hybridisation. Applications to Neurobiology* – (edited by K. L. Valentino *et al.* (1987), Oxford University Press), or *In situ Hybridisation. Principles and Practice.* (edited by J. M. Polak and J. O. D. McGee (1990) Oxford University Press). As a compendium of scientific reviews, the book will probably be more useful in the library than on your own bookshelf since much of the data described will be irrelevant to a single user. In this sense, the strength of *in situ* hybridization, its diversity of application, is the book's Achilles' heel.

DUNCAN DAVIDSON
MRC Human Genetics Unit,
Western General Hospital,
Edinburgh EH4 2XU

X-linked Traits; A Catalog of Loci in Nonhuman Mammals. By JAMES R. MILLER. 1990. Cambridge University Press, 198 pages. £25 (\$39.50) hardback. ISBN 0 521 37389 1.

The mammalian X chromosome has long been a subject of fascination for geneticists both from the view of X-linked inheritance and the mechanism of dosage compensation by X chromosome inactivation. Susumu Ohno (1967) postulated that 'there should be extensive homology of the X-linked genes among placental mammals'. Evidence supporting this postulate, now widely accepted and known as Ohno's Law, has continued to accumulate since 1967 and no exceptions are known for placental mammals. The situation for marsupials and monotremes is less clear cut. Although some of the genetic loci that are X-linked in placental mammals are also X-linked in non-placental mammals, others have been shown to be autosomal.

This book is a catalogue of X-linked genetic traits in non-human mammals and includes entries for a monotreme (platypus), several marsupials (dasyurids, kangaroos, wallabies and Virginia opossum) as well as about 30 species of placental mammals (including African green monkey, American mink, baboon, black rhinoceros, capouchin monkey, cat, chimpanzee, chinese hamster, cattle, deer mouse, dog, donkey, gibbon, gorilla, hare, horse, Indian mole rat, Indian muntjac, mouse, mouse lemur, orangutan, owl monkey, pig, rabbit, rat, red fox, rhesus monkey, sheep, Syrian hamster, vole and wood lemming). The main catalogue follows 22 pages of Introduction with references, two Appendices with references ('X-linked DNA segments in the mouse' and 'the mammalian Y chromosome') and a few pages of explanatory notes on using the catalogue. The Introduction includes several tables of X-linked loci in different species, emphasising the possible homologies, and a diagram

comparing the map positions of homologous X-linked loci in mouse and man. After the catalogue, there is an author index and a subject index, which provides an alphabetical list of over 150 names and synonyms of X-linked genetic traits but does not list the various mammalian species alphabetically. Tables 2 and 4 in the Introduction give some idea of the extent of the available data. Table 4 illustrates that the four genetic loci that encode the enzymes glucose-6-phosphate dehydrogenase, α -galactosidase, phosphoglycerate kinase and hypoxanthine guanine phosphoribosyl transferase have been linked to the X-chromosome in a large number of species (25, 20, 19, 18 species respectively). Table 2 lists the number of known (plus suspected) X-linked loci for man and 17 non-human species. This number is high for man (130 known + 164 suspected loci) and mouse (66+5) but very much lower for all the others. After man and mouse, the three entries with the highest number of X-linked traits are dog (12+3), a group of several species of non-human primates (total of 10+1 for all species) and cattle (9+3). Moreover, as Professor Miller points out, if the data on the above four enzyme loci are omitted only two non-human species have more than five loci available to compare.

Linkage data and descriptions of X-linked traits in the mouse are readily available elsewhere and have been compiled in two editions (Green, 1981; Lyon & Searle, 1989). However, the real value of Professor Miller's catalogue is the descriptions of the X-linked traits of the other non-mammalian species and the putative homologies between traits in different species. This information is not so readily available and the catalogue provides a wealth of comparative information that has been gathered together, after painstaking research, into a well-organized and useful reference work for comparative geneticists. Professor Miller has carefully organized his catalogue so that it can be used as a companion volume to McKusick's (1986) well-known catalogue of human genetic traits. The MIM numbering system is used and helpfully, these numbers are included in both the author index and the subject index. The main catalogue, documenting just over 100 X-linked traits, starts on page 47 with a description of trait 30006 (absent pinnae in the black rhinoceros) and ends on page 173 with trait 31499 (yellow mottling in the mouse). The number of species sharing a homologous trait varies from one (as in the above two examples) to about 20 (the four enzymes mentioned above). Each trait is listed by number and name, followed by synonyms or abbreviations and MIM number (if different from the assigned catalogue number). Names sometimes differ from those used in MIM because they have been chosen to describe the gene product or primary effect of the locus rather than the name of a particular mutation. If a condition is homologous to a human condition and the same name has been used, the catalogue number is the same as the MIM number. If the