analysis – without exception written by giants in the field. Each chapter gives detailed instructions on how to carry out the specialized procedures but you would need to be an experienced cell biologist, molecular biologist and geneticist to supply the background knowledge which obviously has to be taken for granted when preparing such an advanced text. Alternatively, if you have a few years to spare (a laughable idea in this rat race), you could work your way through some of the earlier volumes in the series that has grown apace with this fast moving subject.

The problem that is not addressed at all in most of the chapters and only scantily in the others (e.g. chromosome jumping and linkage analysis) is why and under what circumstances you would want to use the technologies described. What is genome analysis? How do the techniques described dovetail together? For example the PCR technique has been enthusiastically hailed by the clinical geneticists who analyse genomes at a most practical level. There is no discussion of how PCR will be used in this area, nor of the possible pitfalls that must be avoided when life and death decisions depend on the outcome of the procedure. Moving to the wider arena of human genome mapping, it would be interesting to find out whether the contig mapping fraternity believe that their technoloy can be scaled up from the 2000 cell, $< 10^7$ bp nematode to the 3×10^9 bp man. Perhaps the easiest way to put these excellently presented methodologies into context would be to include a fairly brief chapter with a carefully selected reference list on how the techniques have been used and what future adaptations are on the horizon.

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The Biology of Paramecium. (2nd Edition). By R. Wichterman. New York: Plenum Publishing Corp. 1986. 599 pages. US$89·50. ISBN 0 306 420279 9.

Paramecium. Edited by H.-D. Görtz. Berlin: Springer-Verlag. 1988. 444 pages. DM 248 ISBN 3 540 18476 7.

In former times, most university courses in zoology started with the protozoa. First came *Amoeba* and then *Paramecium*. Nowadays, however, protozoa enter the curriculum, if at all, much later, and are usually considered to be important, and worthy of the award of research grants, only in so far as they cause disease in man or agricultural animals. Some certainly do, and cause malaria, sleeping sickness and so on.

However, free-living protozoa are also of enormous interest and research potentiality from a biological point of view. These two books on *Paramecium* make available most of the information which a student or research worker would require. They are written from very different angles: Wichterman's book is in the classical tradition, and deals extensively with taxonomy, morphology and general biology, but also finds space for some more specialized topics. As the author points out in his preface, the book celebrates his half-century 'love-affair' with *Paramecium*. Perhaps its most valuable part is the magnificent bibliography of 4400 titles, starting with Leeuwenhoek's original description of *Paramecium* in 1674 and ending with a considerable number of papers written in the early 1980s.

The other book, edited by H.-D. Görtz, is a collection of thirty chapters dealing with current work on *Paramecium*, prefaced by a succinct foreward by J. R. Preer, who has himself done some of the most important work on the molecular biology of antigen variation, as well as on numerous other aspects of *P. aurelia*.

Probably the peak of interest in *Paramecium* was reached in the 1940s and 1950s as a result of the discovery by T. M. Sonneborn of the 'killer' paramecia and their determinant kappa particles. The latter were at that time thought to be caused by novel genetic units called 'plasmagenes', which aroused much controversy amongst geneticists. Now all this has died down and kappa is seen to be a bacterium with a respectable Linnaean name – *Caedibacter* – living in the *Paramecium* cytoplasm. However we now know that there is a whole world of myriads of endosymbionts (or endocytobionts or endonucleobionts, as they are called by Görtz), living in the cytoplasm or nuclei of *Paramecium*; and there are astonishingly complicated interactions between the genes and gene products of the ciliate host, the endosymbionts and in some cases viruses or plasmids within the latter.

A topic which is of fundamental importance as a model for understanding cellular differentiation in eukaryotes, and one which has *not* died down, is that of the surface or immobilization antigens, here reviewed by H. J. Schmidt. Although the basic genetics of this system was unravelled more than thirty years ago (by Sonneborn and Beale), that was before the era of molecular biology. Recently much has been elucidated but the basic mechanism of switching from one cellular state (controlling antigenic type) to another is still not clear. It seems to be different from the somewhat analagous situations in *Trypanosoma* and yeast. *Paramecium* provides us with exceptionally favourable material for further study of these phenomena. Incidentally, in the course of the recent work on the immobilization antigens, it was discovered that *Paramecium* does not abide by the rules of the 'universal' genetic code. The codons TAA and TAG, which are elsewhere used as stop signals, in *Paramecium* code for the amino acid glutamine and the same occurs in two other ciliates – *Tetrahymena* and *Stylonychia*, but amazingly not in yet another one –

Euplotes, which uses the standard code.It seems that the ciliates have been playing about with different coding systems for a very long time indeed.

Another fascinating cellular system in *Paramecium*, involving nuclear genes and macronuclear and cytoplasmic factors, is that determining the mating types, whose discovery by Sonneborn in 1937 opened up the possibility of doing genetic work with ciliate protozoa. The current position on mating types of *Paramecium* is reviewed by the late A. Kitamura and by Y. Tsukii. Unfortunately, the presumed mating type substances of *Paramecium* have so far not been dissociated from the cilia, and analysis of this system, which has implications for our understanding of self- and non-self recognition phenomena found throughout biology, has been more successfully pursued with other ciliates, especially *Euplotes*.

In some respects, it must be admitted, ciliates stand out as being clearly different from all other eukaryotic organisms. One is the possession of two kinds of nuclei – diploid micronuclei and polygenomic macronuclei. Another is the extraordinarily complex pattern of surface structures. Study of these unique features has produced some very novel findings, which may or may not have a general applicability to other organisms. The beautifully elaborate patterns of surface structure of *Paramecium*, here discussed by J. Cohen and J. Beisson, have been shown to be controlled to some extent by the pre-existing pattern, and to be relatively uninfluenced by the nuclear genome. The molecular basis of this extra-nuclear control is largely unknown, however.

Thus the antigen, mating-type and surface pattern systems of *Paramecium* each offer the researcher abundant material for new discoveries of fundamental importance, as well as innumerable fascinating biological minutiae.

Many other subjects – aging, electrophysiology, species concepts, mitochondria, etc. – are described in the book by Görtz, but space does not permit their discussion here. It seems to this reviewer that for an unprejudiced research worker who is guaranteed a secure position and is free of the necessity to apply for market-oriented research grants, the ciliates – and in particular *Paramecium* – would be the material of choice for a profitable and enjoyable scientific career.

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Antisense RNA and DNA: Current Communications in Molecular Biology. Edited by Douglas A. Melton New York: Cold Spring Harbor Laboratory. 1988. 126 pages. Paper $20·00. ISBN 0-87969-311-8.

The control of gene expression by the highly specific targeting of anti-sense oligonucleotides has been an attractive theoretical model for some time. Unfortunately in practice the introduction of antisense RNA and DNA has often proved ineffective in controlling gene expression. Often it has been the case that once antisense DNA or RNA, whether synthetic or plasmid encoded, has been introduced into the cell little or nothing happens to the levels of the gene products which were supposed to be controlled. Indeed so often is this the case that some have been led to dismiss the idea as impractical, this book is therefore a timely reminder that in some cases theory is borne out by experiment; that in some cases antisense nucleotide regulation of gene expression can and does occur.

The width and variety of the fields in which this technique is being applied is growing constantly. This set of papers from the 1987 Cold Spring Harbor meeting on antisense RNA and DNA constitute a useful set of example systems in which antisense nucleotides are being successfully used to explore genetic controls, RNA processing and gene expression.

Starting with an exploration of IS10 function the papers work up the complexity ladder to experiments on drosophila, mammalian cells and mice. Inevitably as the systems described become more complex the level of understanding of the mechanisms underlying the phenomena seen decreases. In general the review style articles which form the book are readable and clear, though as is so often the case in this sort of compendium little or no room is given over to the experimental details underlying the results discussed; however the references are adequate enough for the diligent reader to sort out much of this for him/herself.

The improving chemistry of oligonucleotide synthesis has led to the availability of a range of modified structures, such as methylphosphonates, phosphorothioates and derivatized oligonucleotides; and the application of some of these newer structures to antisense experiments is introduced. It is, however, in this area where so much has been done recently that the book is at its weakest.

Inevitably the book is out of date, but that does not really detract from its utility as an introductory overview of the field and of the main areas being studied. This alone makes it work a second look.

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