Book reviews

Population Genetics — A Concise Guide. John H. Gillespie. The Johns Hopkins University Press, Baltimore. 1998. Pp. 174. Price £16.50, paperback. ISBN 0 8018 5755 4.

Why do we need a concise guide to population genetics? As the author implies, the answer is that often, lecturers in this field find themselves forced to teach population genetics in courses that last only few weeks. Moreover, a visit to the home pages of various Graduate and Undergraduate Programs in Ecology and Evolution seem to indicate that many do not offer population genetics courses on a regular basis. This is a fairly unfortunate situation and indicates that population genetics has not yet been recognized as a very important subject of study in population biology. It is important to remember that the Evolutionary Synthesis emerged not from new information so much as from new concepts. Most if not all of these new concepts were the direct result of advances made in the field of theoretical population genetics.

Clearly, a thorough understanding of evolution is only possible with a good grasp of population genetics. John Gillespie's book can be a good tool to achieve this purpose but it rests on a fundamental assumption: biology students are keen on learning and using mathematical arguments in order to understand biological processes. Unfortunately, this is not true. Most biology students do not like mathematics but, of course, this is not John Gillespie's fault. In fact, I really liked his book and strongly believe that any open-minded biology student will be able to understand it and use it to learn the basic tenets of population genetics theory.

The book is coherently and logically structured and covers all the most important and incontrovertible aspects of population genetics. Some areas, however, are only briefly addressed. In Chapter 2, some results are based on the infinite-allele model and others on the infinite-site model, but a clear distinction between these two models is never made. The discussion of population subdivision is rather sketchy and does not even mention the stepping-stone models and the concept of isolation by distance. On the other hand, the chapter on natural selection is fairly thorough and Chapter 5 covers all the most important aspects of quantitative genetics. The inclusion of a chapter on the evolution of sex (Chapter 6) is quite useful because it shows the student how population genetics theory can be used to try to understand one of the most important problems in evolutionary biology. This chapter is not intended to be a thorough review of the subject and therefore does not discuss all possible explanations for the evolution of sex; only genetic theories are included.

One feature of this book that I especially liked is the use of a particular paper rather than a summary of several

when discussing applications of the theory. This approach allows the reader to become involved with the literature very quickly. The mathematics needed to understand this book is fairly basic and the appendices provide most of what is needed. The derivation of most equations are explained very thoroughly allowing students to follow the basic steps needed to obtain the most important results in population genetics theory. All in all I recommend this as a good introductory book that can be used in both undergraduate and graduate courses. In some instances, however, it may be necessary to supplement the book with material that will motivate less mathematically oriented students.

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DNA Markers and Breeding for Resistance to *Ascochyta Blight* in Chickpea. S. M. Udupa and F. Weigand (eds). ICARDA, Aleppo. 1997. Pp. 222. Price FREE, paperback. ISBN 92 9127 047 4 (available from Documentation and Information Services, ICARDA, P.O. Box 5466, Aleppo, Syria).

To many people, breeding for plant disease resistance using molecular techniques means genetic modification, but biotechnologists have other powerful tools of value to the plant breeder. DNA marker techniques have developed rapidly in the past few years and a number are now available to help the breeder and pathologist in the development of strategies for improved disease resistance.

Ascochyta blight in chickpea, caused by *Ascochyta rabiei*, is one of the most important diseases of this crop in many parts of the world and is a major limiting factor in the West Asia and North Africa Region. Breeding for disease resistance has not proved to be very successful because of the high degree of variability in pathogenicity within *A. rabiei*. The hope is that molecular marker systems, and in particular microsatellite markers, will be a means of rapidly mapping genetic diversity in the pathogen and pyramiding appropriate resistance genes in the host.

DNA Markers and Breeding for Resistance to Ascochyta Blight in Chickpea is a free book published by the International Center for Agricultural Research in Dry Areas (ICARDA), and is a collection of papers presented at a symposium aimed at reviewing past progress in, and formulating future strategies for, the application of DNA markers to chickpea production. Papers have been grouped under two main headings: 'Population Biology of

the 'Host-Pathogen Interaction' and 'Host-Plant Resistance'. Each chapter is self-contained and does not necessarily build on those preceding it. The main disadvantage of this is that there is a considerable amount of repetition, particularly in the description of the disease and the damage it causes, and accounts of DNA marker systems. However, overall the book does provide a comprehensive and up-to-date account of the problems facing chickpea breeders, variation within *A. rabiei*, and work on the development of molecular markers for resistance breeding.

The book will obviously be of interest to breeders, pathologists and biotechnologists working on *Ascochyta* blight of chickpea and its control by breeding for disease resistance; indeed, I expect that most of them will have been at the symposium and will have their own copy already. However, the book may well also be of more general interest to those looking at the application of molecular marker systems to disease control situations.

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Telomeres and Telomerase (CIBA Foundation Symposium 211). Derek J. Chadwick and Gail Cardew (eds). John Wiley and Sons, Chichester. 1997. Pp. 238. Price £57.50, hardback. ISBN 0 471 97278 9.

For several years there has been a tacit assumption that telomeres and telomerase are involved in cellular senescence and/or immortalization: in short that they are players in organismal ageing and cancer. Although large amounts of resources have been expended the jury is still out, making the time ripe for a collaborative discussion of telomere biology.

The book consists of a series of chapters contributed by speakers at the Ciba Symposium on 'Telomeres & Telomerase' held in February 1997. Each chapter is followed by the accompanying discussion. There are also several more general discussions in which key questions are raised. The topics covered fall into the following categories: the DNA end replication problem and mechanism of action of telomerase; the regulation of telomerase activity; alternative mechanisms of telomere maintenance; and telomere length and its relevance to cellular ageing and cancer. In the general discussions topics such as non-telomerase mechanisms for telomere maintenance, and whether telomeres are correlative or causative in cellular senescence are debated.

We begin with an informative section on basic biology: the interaction of telomeres and telomerase and the process of DNA end replication (Blackburn, Cech). There follows a discussion of recent findings in non-mammalian systems: the power of mutant screens in yeast (Lundblad) and the unusual nature of telomere elongation in the fruit

fly (Biessmann). This draws attention to the possibility that other pathways for telomere maintenance may exist instead of, or alongside, telomerase. The importance of telomere-binding proteins other than telomerase in yeast telomere length regulation is presented by Shore.

The second half of the symposium addresses the situation in human and rodent cells. Chapters from Guarente, Shall and Harley deal with the way in which telomeres appear to have a role in cellular ageing. Comparative studies of the telomere hypothesis in various species are difficult because of heterogeneity in telomere length and possible differences in the significance of cell mortality as a tumour suppressor mechanism. Harley emphasizes that the telomere hypothesis is not meant to explain everything. This is a qualification which has often been lost in the media hype surrounding the 'telomeres and ageing' topic. Shay underlines the potential usefulness of telomerase activity as a diagnostic and prognostic tool in cancer. In rodents, however, telomerase activity appears to be much more widespread and although levels increase during tumour progression, this appears to be a relatively late event (Blasco). Newbold demonstrates the power of somatic cell genetics in identifying a repressor of telomerase activity on human chromosome 3p21.1–p21.3. Isolation of this gene, which appears to play a crucial role in regulating telomerase activity and hence may be an important target for inactivation in cancer, is eagerly awaited. In recent months intriguing links between several proteins involved in DNA repair and recombination and telomere length regulation have emerged and this aspect is presented by Lindahl. Finally, Lansdorp presents his quantitative FISH method for measuring the amount of (TTAGGG)_n repeat at individual chromosome ends; data which suggest that end-autonomous length regulation may exist, another exciting and unforeseen development.

One of the most attractive features of the Ciba Foundation's series are the discussions that follow each chapter, all of which are easily understood; often the reader's own questions are answered in this section. For example, the symposium draws out important differences between human and rodent systems, over which there has been some confusion. The chapter contributions vary considerably in length and in some cases the chapter and the subsequent discussion do not correspond. For example, the chapter from Blasco focuses on work with various mouse models of tumorigenesis, while the discussion which follows is largely concerned with the knock-out mouse for the telomerase RNA gene. This places the reader at something of a disadvantage. The main drawback of the series is the inevitable time lag between the actual symposium and the printed version. A book in such a fast-moving field runs the risk of being seriously superseded before publication and already many of the contributions are dated: for example, in the interim the catalytic component of human and mouse telomerase has been cloned and the effect on lifespan of constitutively expressing the gene in primary human cells has been reported. Moreover, the role of telomere-binding proteins

in vertebrates, an area of research which has blossomed in the last eighteen months, is not represented. However, these deficiencies make some of the discussion points interesting from an historical perspective — what were people's views 12 months ago and who was right? Disappointingly, but understandably, most of the contributors were cautious in their opinions and nothing controversial appears to have been immortalized in print. Overall the present publication clarifies the situation as it stood 12 months ago and is a springboard from which new, rapidly emerging, data can be assimilated.

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Evolutionary Genetics (2nd edn). John Maynard Smith. Oxford University Press, Oxford. 1998. Pp. 330. Price £19.95, paperback. ISBN 0 19 580231 1.

The new edition of John Maynard Smith's excellent textbook does not differ greatly from its predecessor. Changes have been made largely to improve clarity, and not, for the most part, to incorporate research carried out in the nine years since the first edition. The subject areas include the theory of evolution by selection and drift, quantitative and multilocus genetics, and the particular questions of genome evolution and evolutionary processes in prokaryotes. We are reminded of the remarkable range of evolutionary problems in which Maynard Smith has made important contributions. Throughout, the text is illuminated by the author's extraordinary insight and clarity of thought. Particularly featured are theories of the origin and maintenance of sex, evolution in structured populations and the concept of evolutionary stable strategies. The style is very much in keeping with Maynard Smith's research. The fundamentals of evolutionary biology are here defined by ideas, not by the exhaustive documentation of the phenotypes of living things, and the concern is more about the evolutionary process than with the specific patterns of organismal diversity. The approach is quantitative, and model-based — all chapters include numerical problems, many of which require computer simulation for their solution. Maynard Smith seems to think that the evolutionary explanations that do not make sense are not explanations at all, and he is right.

Among behavioural ecologists, Maynard Smith's creation of evolutionary stable strategy (ESS) theory is seen as his major contribution. In the account here, the theory is linked to diploid population genetics. In a sexual species, does the genetic system allow a polymorphism whose frequencies correspond to a mixed ESS? ESS theory has not only freed the explanation of animal behaviour from fatuous human analogies, but also it has been the first method to deal adequately with the problem of conditionality. This problem is that, while it might be quite straight-

forward to calculate the optimal behaviour of organism B conditional upon the actual behaviour of organism A, this is of little use unless the asymmetry of B being allowed to make behavioural decisions conditional upon A, but not *vice versa*, can be justified. In ESS theory, adjustments come in gene frequency changes, not in the decision-making processes of individual organisms. Testing of ESS theory is now paramount, although the problem here comes from the theory's requirement that payoffs are prior to, and independent of, strategies. In reality, organisms performing maladaptive behavioural strategies are unlikely to perform them well. This leads frequently to a conclusion that organisms' behaviours are ESSs when, in reality, all that can be said is that they are under stabilizing selection.

All biologists would benefit greatly from reading this book, and I would recommend it very highly as a teaching aid for advanced undergraduates.

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Epigenetics (Novartis Foundation Symposium 214). Derek J. Chadwick and Gail Cardew (eds). John Wiley and Sons, Chichester. 1998. Pp. 305. Price £57.50, hardback. ISBN 0 471 97771 3.

In June 1997, under the direction of Alan Wolffe, Novartis gathered together a group of people to discuss the subject of 'Epigenetics'. It has been realized for a number of years now that many different phenomena fall under this umbrella, and breadth of coverage was clearly one of the factors influencing the selection of the participants for this symposium. The contributions are focused on the problem of how control of gene expression can be inherited at cell division, but they range from a consideration of the role of mCG-binding proteins in vertebrates, through long-range chromatin effects (a paper that was met by healthy scepticism from the audience) and co-suppression in plants, to the separate imprinting of the two DNA strands in yeast.

Each talk was followed by a discussion period which was not restricted to the presented material and this broadened even further the subject of the meeting. This is a very desirable feature of these meetings of experts but it does test their awareness of ongoing and also long published work in other laboratories. After every two or three talks there was a general discussion but these tended to be rather diffuse, even anecdotal, and the report gives the impression of a room of contributors eager for coffee. However, it is the report of these discussions that brings the subject to life and some of the comments greatly enlightened my reading. The final discussion led to some bickering about whether an imprint can still be said to exist when it is masked!

The book starts with Adrian Bird describing why he believes the role of DNA methylation is to suppress un-needed, background transcription. Alan Wolffe describes how this can occur through modulation of chromatin structure so that, by compartmentalization, the ratio of initiations possible in active chromatin is 10^7 times that found in inactive chromatin. Bird proposes that specific demethylation would be a mechanism of gene activation in development or differentiation but this is hotly disputed by Tim Bestor who claims that no evidence for such activation has been reported.

In a later section, Art Riggs presents a summarizing figure showing three ways (none exclusive) in which methylation can affect transcription. This is part of an insightful view of methylation, showing it to be a dynamic process, but it is not clear how the dynamics are affected by the 'rectification' mechanisms proposed by Peter Laird.

Three papers are concerned with organisms that lack DNA methylation. In particular, Susan Gasser describes the role of Sir proteins in budding yeast. Sir2p is limiting but Sir3p and Sir4p are held in a reservoir (derogatively described as a waste bin by one of the questioners) for use in repression when the need arises.

Marjori Matzke points out that many plants and most vertebrates are polyploid and all systems have some genes (e.g. histone, rRNA) in multiple copies and she queries what effect this has had on our 'methylation history'. Nina Fedoroff gives a surprisingly clear presentation of the complex problem of the maize *Spm* transposon. The

major product of this transposon is TpnA which binds to *Spm* DNA and it is proposed that this protein directs demethylation of the transposon thereby facilitating transposition. Dick Flavell and Jan Kooter describe contrary findings on co-suppression which is clearly a field for further study.

Towards the end of the book we turn to areas where a role for DNA methylation has been clearly established (i.e. X-inactivation and imprinting). However, some disquiet greeted the 'interesting new insights' in the report that H19 transcripts are not required for imprinting: rather, a region from -2900 to -1690 bp upstream of H19 is critical and this region also causes silencing in *Drosophila*.

This book is not for someone with a general interest in epigenetics. Rather it is for those who work in the field to maintain a broad outlook on the subject. Not all the papers will appeal to all readers and some of the details can be skipped over. It also suffers from the problem that there is little new material in most of the papers. However, it provides a body of evidence that can be referred to and it highlights areas of controversy and ignorance: areas for future research.

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Books received

Genetics (5th edn). Peter J. Russell. Benjamin/Cummings Publishing Co. Ltd, Menlo Park, California. 1998. Pp. 805. Price £26.99, hardback. ISBN 0 321 00083 2.

MHC Volume 2 — A Practical Approach. N. Fernandez and G. Butcher (eds). IRL Press (Oxford University Press), Oxford. 1998. Pp. 235. Price £27.95, paperback. ISBN 0 19 963555 2.

Evolutionary Biology Vol. 30. Max K. Hecht, Ross J. MacIntyre and Michael T. Clegg (eds). Plenum Press, New York. 1998. Pp. 369. Price \$89.50, hardback. ISBN 0 306 45674 5.

The Genetics of the Pig. M. F. Rothschild and A. Ruvinsky (eds). CAB International, Wallingford. 1998. Pp. 622. Price £85.00, hardback. ISBN 0 85199 229 3.