

Book Reviews

Chromosomal Aberrations: Basic and Applied Aspects.

Edited by G. OBE and A. T. NATARAJAN. Berlin, Heidelberg: Springer-Verlag. 1990. 319 pages, 100 Figures. Price DM 198. ISBN 3 540 52540 8.

The volume comprises the text of 27 full papers presented at a meeting in Essen, and is dedicated to Professor R. Rieger on the occasion of his 60th birthday in recognition of his outstanding contributions to cytogenetics. A wide variety of problems of current interest are covered by the authors, all of whom are internationally recognised and actively engaged in the fields they present.

The first six papers reflect the increasing awareness that chromosomes within the interphase nucleus are not 'isolated threads whose broken ends wander around looking for partners' but are integrated within an intranuclear architecture which conditions, together with the various protein systems, like topoisomerases, the formation of structure changes. Inevitably, the nature of the basic lesions which lead to aberrations is discussed, the importance (though not the exclusivity) of the double strand break is stressed and three papers (nos. 7–9) survey the evidence derived from the actions of restriction endonucleases when introduced into nuclei.

The next four papers (nos. 10–13) look at some aspects of aberrations in relation to cancer and to the inherited Chromosome Instability syndromes, all of which have a bearing upon the way the cell deals with potential aberration lesions.

Ionizing radiation has been and continues to be an important and potent clastogen both experimentally and environmentally. Recent events have highlighted the possible importance of very low doses and dose-rates, and papers 14–17 look at the 'adaptive response', the protective effect found in some cell systems when a very small priming dose (~ 1 cGy) is given some hours before a much larger (0.7–1.5 Gy) challenge dose. Effects of bomb radiations at high and low levels are dealt with in papers 18 and 19.

Chromosome aberrations (and their subsequent product – micronuclei) have assumed considerable importance in recent years as a means of biological dosimetry in the case of radiation accidents and also for screening potentially mutagenic and carcinogenic compounds. These topics form the subjects for the concluding papers (20–27) with a timely reminder that quantitative results can be warped by extreme culture conditions (26) and by the life-style and genetic make-up of the cell source (27).

There is much in this volume that will be of interest to all concerned with clastogenicity. The papers are mostly short, very readable and with good collections of relevant references. There is a very detailed subject index at the end that I found most helpful. The editors have done an excellent job, not only in arranging the material in logical fashion but in producing the book within memory of the conference.

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Genetic Conservation of Domestic Livestock. Edited by LAWRENCE ALDERSON. Wallingford, Oxford: CAB International. 1990. 242 pages. Price £25.00. ISBN 0 85198 669 2.

The deliberate conservation of breeds of farm livestock is a recent but expanding business, following on the much more extensive and systematic efforts that have been made to maintain diverse varieties of plants. The reasons for conserving livestock variety have been extensively aired; the following summary by Rudge in this volume will suffice: '1. Genetic insurance – we never know what might be needed in future. 2. Scientific study – mechanisms of evolution/selection, behaviour, physiology. 3. Practical use – present applications to husbandry and markets. 4. Sentiment – history, culture and public interest'. Whilst those in the business often argue that the first three of these are the main justifications for effort and expenditure, I suspect the real motivation for most people is the last. That is nothing for them to be ashamed of, unless they have used arguments other than sentiment to obtain funding.

The possible economic benefits may well be greater in developing regions where stock performance is not as well documented as in those countries with more advanced agricultures and better explored alternative breeds and strains. Thus FAO expends substantial resources on conservation and evaluation of germ plasm resources, primarily in the developing world. Rates of genetic improvement are sufficiently high and are continuing without apparent plateaux in commercial livestock, certainly poultry, pigs and dairy cows, that conserved breeds maintained without improvement are increasingly less likely ever to contribute useful genes. It becomes better to change direction than start again. Thus in my view, the only reason for conservation of livestock in developed

agriculture is for sentiment and culture, worthy nevertheless.

Those who write or speak on livestock conservation are in favour of it; sceptics are not invited or do not go to the party. The contributors to this volume include many of the regular party goers. It comprises papers given at an International Conference, called on behalf of the Rare Breeds Survival Trust, which was held in Warwick, England in 1989. Lawrence Alderson, who edited the volume, is Technical Consultant to the Trust and the driving force for much of the effort on livestock conservation in Britain. The Prince of Wales, Patron of the Trust, gave an opening address, arguing 'there is a long overdue requirement for a co-ordinated programme of genetic conservation in the developing world ... This obviously will require international collaboration on a grand scale, but if this is possible when tackling the greenhouse effect and the holes in the ozone layer, surely it can be done for global gene banks as well. In the long term they may be just as important for our continued survival.' His Royal Hype?

The volume is nicely illustrated and presented, and is in three parts: Regional programmes, Philosophy and methodology of conservation, and Research studies and biotechnology. The scientific quality of the 23 chapters (3 by Alderson) varies, but most are interesting.

There is an impressive amount of work going on around the world, obviously much of it on documentation, for a breed has to be identified before it can be conserved. Rules vary, for example in Britain a rare breed of cattle has *inter alia* to have had a herd book for six generations, with less than 20% immigration, less than 750 breeding females or four or less distinct male lines (no common parents, grandparents or great grandparents). As someone used to keeping laboratory populations of mice, this seems to me a large population, but of course the breed is not under one person's control and may well be more sensitive to inbreeding.

The difficult problem addressed by several authors is the genetic objective of rare breed conservation: For example is it to maintain the current mean and variance, or should the population evolve in a similar way to commercial breeds so some competitiveness is maintained? Is conservation only worthwhile if the animals can be seen in the flesh, or are frozen embryos or semen sufficient? The answers to these questions help to determine what are minimum population sizes, for example. Again, I was a little surprised to see how conservative people were; for example one suggestion was that at least 90% heterozygosity should be maintained for 200 years. These would imply rates of inbreeding below those found in commercial livestock or long term laboratory selection experiments. I found in the book several mentions of the need to maintain large numbers of males, none (that I noticed) emphasizing the importance of

equalizing family size, but a lot on the less obvious value of subdividing into lines with rotational breeding. I also found no mention of the role of mutation in generating variation; judging by current estimates it is not trivial in populations of the size described here.

There are nice studies, e.g. by Bowling, of heterozygosity in populations, but other studies are more confused and some of the genetics is weak. I was, for example, intrigued by Gill and Kelly's opening sentence: 'The value of the coefficient of inbreeding, devised by Wright, as a measure of homozygosity has been subject to increasing criticism' (no reference given, but Alderson picked up the point in his preface). Yet Gill and Kelly describe co-ancestry of many animals in the Irish Moiled Breed before turning to polymorphisms, and they optimistically add: 'The combination of genetic markers generated by ... blood group studies ... enzyme polymorphism studies ... [and] fingerprinting may then ... allow a programme to be maintained which permits the maintenance of homozygosity for the breed-character genes whilst maximising the survival of variation at other loci.' I was also puzzled as to how Hodges thought that storage of particular regions of DNA was going to do much for livestock conservation.

In summary, this is an informative introduction to genetic conservation of livestock, to its problems, practices and prejudices.

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Genetic Data Analysis. By BRUCE S. WEIR. Sunderland, Massachusetts: Sinauer Associates, Inc. 377 pages. Price £21.95 (pbk). ISBN 0 87893 871 0/872 9 (pbk).

The subtitle to the book is 'Methods for discrete population genetic data'. Weir reminds us in the first chapter of the importance of this subject by reviewing the segregation data collected by Mendel (and, according to Fisher, adjusted). Analysis of discrete genetic data is not just an old-fashioned topic however, as illustrated by the last chapters on the currently very active subjects of statistical analysis of DNA sequence data and construction of phylogenies from them.

Among the other subjects covered are estimation of gene frequency data for multiallelic loci, estimation and testing for Hardy-Weinberg and linkage disequilibrium, analysis of gene frequency among populations and inferences of population structure, estimation of linkage and selection effects, and inferences about paternity. It is indeed a comprehensive coverage of analysis of discrete data. Analysis of continuous traits or of counts such as litter size is not discussed.

The book has its origins in a course for students of genetics or statistics and requires only a knowledge of the principles and little of the detail of either discipline.