significant differences in length between some of these Ys, and Kodama & Sasaki (1977) found that, when the 66 pairs of strains which could be made from the twelve strains they measured were tested statistically, 39 pairs were significantly different from each other. This is an odd statistic which is difficult to make sense of, and a proper analysis of the data would be of interest. I deduce from simple assumptions that the number of strains with Y chromosomes of significantly different lengths among these twelve strains is more than two, very probably three and just possibly four. *Genetical Research* (1991, **57**, 195) has recently published details of the first reported deletion in the mouse Y chromosome, which causes a marked reduction in length. Can any of the rat Ys carry deletions or additions?

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Mammals from Pouches and Eggs: Genetics, Breeding and Evolution of Marsupials and Monotremes. Edited by JENNIFER A. MARSHALL GRAVES, RORY M. HOPE and DESMOND W. COOPER. CSIRO Publications, PO Box 89, 314 Gilbert Street, East Melbourne, Victoria 3002, Australia. 1990. 337 pages. Hardback US $50.00. ISBN 0 643 05020 5.

As an undergraduate in the late 1950s I gained the impression that monotremes and marsupials were interesting experiments of Nature, but nevertheless 'failed' mammals – ones that did not make the evolutionary ascent to the eutherian pinnacle. Since then, with the pioneering investigations of Sharman followed by those of Tyndale-Biscoe, Renfree and an ever-increasing number of others, numerous long-held misconceptions are being redressed: we have learned to regard the marsupials not as 'inferior' but rather as 'alternative' mammals – ones that have substituted investment in lactation for gestation as a reproductive strategy.

Marsupial research has accelerated enormously in the last two decades. With the recent introduction of the South American opossum, *Monodelphis domestica*, as a biomedical model, numerous laboratories outside Australia (including the U.K.) are also engaged in this pursuit. These considerations together with the current interest in sex determination and conservation, and the general lack of information available on the genetics of non-eutherian mammals, makes the publication of *Mammals from Pouches and Eggs* most timely.

This volume brings together topics discussed at a Boden Research Conference held in Australia in 1988 and subsequently published in the *Australian Journal of Zoology* (vol. 37, 1990).

The stated aim of the editors is to make available information on marsupials and monotremes to 'anyone in the field, entering the field or simply curious' and in this they succeed admirably. The book contains a wealth of information on breeding and conservation, genetics and cytogenetics, reproduction, sex determination and evolution contained in 25 lucidly written chapters, each of them well referenced. However, only a single chapter is devoted exclusively to Monotremes.

The text is grouped into four sections: I. Genetics and Reproduction; II. Immunological and Molecular Approaches to Marsupial Phylogeny; III. Chromosomes and Gene Maps of Marsupials and Monotremes; and IV. Chromosome inactivation and Sex Determination in Marsupials.

The comparative approach is maintained throughout, and much insight is to be gained thereby. Take the search for the sex-determining gene: three years ago ZFY on the eutherian Y chromosome was a putative candidate, until it was found that in marsupials its homologue mapped to an autosome; this immediately threw doubt on the sex-determining function of ZFY.

Comparative studies also suggest that X chromosome inactivation has arisen in a stepwise fashion during the course of evolution, since monotremes show incomplete, tissue-specific X-inactivation; marsupials (and the primitive endoderm of eutherians) are characterized by incomplete paternal X-inactivation, while eutherian embryos show random and incomplete X-inactivation.

As a developmental biologist I found the chapters on sex determination the most intriguing. Since the pioneering work of Jost in the 1950s, mammalian sex determination has been considered as involving transformation of the indifferent gonad into a testis by the Y chromosome, followed by testosterone secretion, which then brought about masculinization of the rest of the reproductive system. In the absence of a Y chromosome a female would develop, by default. In marsupials, however, scrotum, pouch and mammary gland development are under primary genetic control and make their appearance prior to gonadal sex differentiation. The search is now on for sexual dimorphisms in eutherians that precede gonadal differentiation, and Shaw *et al.* quote several examples of this from the recent literature. As these authors state, 'studies in marsupials are alerting us to the fact that the hormonal control of sexual differentiation overlies a more fundamental genetic control system'.

The homologies of pouch and scrotum have long been debated. Based on their studies of intersex marsupials Sharman *et al.* postulate a locus on the X chromosome which in single dose would induce scrotum development and in double dose pouch and mammary glands. They show a fascinating photo of an XXY kangaroo with penis and pouch but no scrotum. However, the recent description of mammary rudiments in normal male *Monodelphis domestica* suggest the hypothesis is inadequate.

A few minor errors only were noted: the misspelling *Monodelphis domesticus* (p. 7) and Razzin & Riggs (p.

280); not all eutherian 'oocytes remain suspended in dictyate' as stated (p. 88); Riggs, 1989 (p. 272 & 280) appears in the text but not in the references – but these largely editorial matters do not detract from the excellence of this publication.

The book will appeal to a wide readership and should find a place in every genetics and zoology library.

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Production of Biologicals from Animal Cells to Culture. Edited by R. E. SPIER, J. B. GRIFFITHS and B. MEIGNIER. Butterworth Heinemann. 1991. 826 pages. Hardback, £90.00. ISBN 0 7506 1103 0.

This book gives an edited version of the papers presented at the 10th meeting of ESACT, the European Society for Animal Cell Biotechnology. ESACT has held meetings in nine countries over the last 15 years, with participants rising from 75 to over 350, while interest has moved from vaccines for foot-and-mouth disease and polio to monoclonal antibodies, recombinant proteins and recombinant vaccines. The general emphasis is, of course, on products of commercial value, and the 135 contributions to this volume make it clear that the whole area of animal cell biotechnology is very active.

The first paper is the Hyclone Award Lecture, by N. B. Finter of Wellcome Technology Ltd, Beckenham, Kent, entitled 'Animal cell culture: the problems and rewards'. After a brief summary of the successful development of their foot-and-mouth disease vaccine, now manufactured in many parts of the world, Finter describes their problems in making interferons. A British Medical Council committee set up in 1959 gave up after 12 years, but stubborn scientists at Wellcome took up the challenge and gradually solved the problem, producing 'Wellferon' in commercial quantities by 1980.

The remaining 134 papers, all much shorter and some followed by discussion or argument, are arranged in 11 sections with the following titles: (1) Cell Lines and their Characterization; (2) Nutrient Media with Special Supplements; (3) Serum-free and Protein-free Media; (4) Cell Physiology; (5) Gene Expression in Animal Cell Systems; (6.1) Bioreactors: Overview, (6.2) Bioreactors: Hardware, (6.3) Bioreactors: Particles, (6.4) Bioreactors: Membranes and Perfusion, (6.5) Bioreactors: Optimization via Metabolism, (6.6) Bioreactors: Comparative Studies; (7) Monitoring and Assay of Animal Cell Parameters; (8) Kinetics and Modelling; (9) Downstream Processing; (10) Products; (11) Regulatory Issues, which ends with paper 135 on The Media-Cult Hybritest–a new test for *in vitro* toxicology. Lists of exhibitors and participants, and subject and author indexes, bring the book to a close.

It is not possible here to discuss the immense amount of information in these papers, so I will simply paraphrase a few points made by the three editors in their introduction. Bioreactors still command intense attention (32 papers), but downstream processing and regulatory aspects, including quality control and assurance activities, need more study, since they will be the prime determinants of commercial success or failure. Use of the DNA fingerprint technique for identifying cell lines led to controversy since, for example, Hela and BHK cell lines could be distinguished, but not Hela and another human cell line (WI 38), and it would be impossible to distinguish an engineered cell line and its original host cell by this technique. Different investigators failed to agree about the value of two enzymes as indictors of cell lysis and therefore cell numbers in growing cultures. These were lactic dehydrogenase and the enzyme system involved in proteolysis: some reports claimed success and others failure (instability) with these systems.

Cell biotechnology is clearly a research area of growing interest, importance and commercial value, and I suggest everyone should be aware of this book and should keep an eye open for ESACT's 11th volume.

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Plant Population Genetics, Breeding and Genetic Resources. Edited by A. H. D. BROWN, M. T. CLEGG, A. L. KAHLER and B. S. WEIR. Sunderland, MA, USA: Sinauer. 1990. 449 pages. Hardback £47.95, paperback £27.95.

In this book the editors have assembled a wide-ranging collection of papers in the general area of applied plant genetics. The book arose from a symposium held in Davis, California, in 1988 to honour Professor R. Allard, and contains over 20 distinct and individualistic views of the present state of the subject. In order to impose some order on these varied topics they have been loosely grouped under the headings of Genetic Diversity, Evolutionary Processes and Breeding & Genetic Resources.

The Diversity section includes a theoretical study (Weir) of the distributional properties of the genetic diversity measure (1-SS of allele frequencies) in different types of population and illustrates the use of the methods. This is followed by a comprehensive survey of the current literature on allozyme variability in plant populations, which has enabled the authors (Hamrick & Godt) to produce some useful and reliable generalizations on the actual distribution of variability within and between populations and the relationship of this to the breeding system. Following this theme, Gepts emphasizes the potential value of storage proteins as measures of genetic variation, particularly in the context of relationships within and