

Manipulation of the Avian Genome. Edited by ROBERT J. ETCHES and ANN M. VERRINDER GIBBINS. CRC Press, Corporate Blvd., N.W., Boca Raton, Florida 33431. 1993. 332 pages, hardback. Price £72.00. ISBN 0 84934216 3.

This book comprises the published proceedings of a meeting held under the auspices of the Keystone Symposia Organization held at Lake Tahoe, California in March 1991. The editors and organizers are to be congratulated, both on the well-balanced range of contributors at the meeting and on the high standard of the publication which has resulted. Unlike the proceedings of many symposia, this reads as a well-balanced account, with little overlap between contributors, but with appropriate cross-referencing between articles. It is a manageable size, making a coherent story from cover to cover. It also has a reasonable index, and will undoubtedly prove a useful reference work for those working in, or about to enter the field. There are in all 19 articles from contributors with diverse backgrounds ranging from molecular biologists, cytogeneticists, embryologists, to poultry industrialists.

Although the title refers to the avian genome, with the exception of the article on constant and variable features of avian chromosomes (Bloom *et al.*) which considers a range of birds, most of the articles are confined to the domestic fowl. Clearly a long-term objective is the improvement of commercial poultry stocks by transgenic strategies, but a more immediate gain is anticipated from nontransgenic molecular methods. The poultry industry is prominent amongst the meeting's sponsors. The subject areas covered fall into the following broad categories: anatomy of reproduction, embryology, cytogenetics, the formation of chimeras, methods of gene transfer into the avian genome, genes desirable for transfer, DNA fingerprinting, sex-specific DNA and the importance of gene manipulation to the poultry industry.

In the introductory chapter Etches puts avian gene manipulation into perspective by contrasting our level of understanding of different genes. The gene controlling hen-feathering is that encoding aromatase. This has been located on chromosome 1, and its mRNA sequenced, and its expression has been well-studied. By contrast the genes controlling growth are poorly understood. However, it is the latter which are regarded by the poultry industry as most desirable for gene manipulation. Bakst (Chapter 2) outlines well the salient features of the anatomy of the male and female reproductive systems, emphasizing those which are important for understanding some of the practicalities of gene manipulation. Eyal-Giladi (Chapter 3) discusses the first 40 h of embryonic development up to the primitive streak stage. The complete lack of figures in this chapter is unfortunate since molecular biologists may be unfamiliar with the details of embryology. General features of the avian

chromosome, including constitutive heterochromatin, ribosomal RNA genes and genomic variability are well described in the fourth chapter. However, I feel there is a slight lapse in the otherwise high editorial standards in this chapter, and a number of unnecessary and undefined abbreviations have been allowed to creep in. A few examples will illustrate this: RBG and SRY are not defined, SCD (sister chromatids), MGF (multigene family) and ORP (out-of-register pairing) are each used only once after defining, microchromosomes and macrochromosomes become MICS and MACS. The policy adopted by many journals is that abbreviations which are not standard should be kept to a minimum compatible with clarity and conciseness.

In chapter 5 on the genetic map and genetically diverse stocks, Bitgood expounds what might be called the 'classical' geneticist's viewpoint. He is concerned that funding agencies do not recognize the importance of gene mapping in the domestic fowl, and that many lines of domestic fowl are being disposed of, for lack of funding. He then illustrates very elegantly how the combination of cytogenetic and classical genetic data, using translocation markers, has brought about a significant change in the map for the Z chromosome, namely, inversion of its orientation when compared with the earlier (1983) map. There are two chapters on chimeras. The first by Petite *et al.* (Chapter 6) describes the successful formation of intraspecies chimeras, and is aimed at the introduction of genetically modified blastodermal cells into recipient embryos. The second, by Dieterlen-Lièvre and Le Douarin (Chapter 7) concerns quail/chick chimeras. This well-illustrated chapter explains how these chimeras have contributed to understanding the ontogeny of practically all cell lineages in avian development. Cells of quail origin can be distinguished from those of chick by the presence of a prominent mass of heterochromatin in the nuclei of the former, and hence their migration in the developing chimeras can be easily traced. There follow chapters on transfection of chick embryos maintained under *in vitro* conditions (Sang *et al.*, Chapter 8) and the use of retroviruses in gene transfer (Salter *et al.*, Chapter 9). The spatial localization of transcripts of the homeobox sequence *CHox-cad* during different stages of embryonic development has been studied by Gruenbaum *et al.* (Chapter 10). There are suggestions that homeobox genes may be important in regulating certain quantitative traits, such as body weight and egg production.

Concurrently with the development of gene transfer into the avian genome, consideration has to be given to which genes are the prime candidates for transfer. With this in mind, the genetic control of growth (Goddard *et al.*, Chapter 11), the major histocompatibility complex (Lamont, Chapter 12), egg proteins (Deeley *et al.*, Chapter 13) and disease resistance (Gavora, Chapter 15) are the subject of

four further chapters. In an after-banquet speech Shoffner (Chapter 14) makes a wide-ranging review of poultry genetics from its inception as seen by a participant with over 50 years experience. Multilocus DNA markers and their uses, including identification of genetic stocks and breeding lines, and selection of quantitative trait loci, are reviewed by Hillel *et al.* (Chapter 16). Mizuno *et al.* (Chapter 17) have made a detailed examination of the W chromosome, present only in the heterogametic sex, which in birds is the female. This chromosome comprises only about 1% of the total DNA and contains at least three repetitive sequence families which make up the majority of its DNA. One of these families (*XhoI*) can be used as a sex-specific probe, which has enabled them to determine the sex of early embryos. They were then able to study the divergent gene expression of the enzymes catalysing the synthesis of sex hormones in both male and female embryos.

In the penultimate chapter Emsley (Chapter 18) assesses the present and future potential of the new technologies for the poultry industry, and concludes that poultry-breeding companies will continue to monitor developments and will adopt new technology

when it appears to be promising, although substantial changes before the year 2000 seem unlikely. Finally Ann Gibbins (Chapter 19) discusses strategies for mapping the chicken genome and for gene targeting. She stresses the importance of more effective communication between molecular biologists and members of the poultry industry, and in a footnote announces the first issue (October 1991) of a newsletter to report developments of strategies for the manipulation of the avian genome. It is a pity that over a year later the second issue has not appeared.

The recent developments in avian genome manipulation have been far more impressive than were anticipated a decade ago, but in spite of this, many contributors are cautious in predicting the scale of developments for the next decade.

Manipulation of the avian genome is the first book to be published on this subject and fully deserves to become the standard reference work in the field.

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