# BOOK REVIEW

**Annual Review of Genetics**, vol. 22, 1988, pp. 704, (eds) Allan Campbell, Bruce S. Baker and Ira Herskowitz, (Published by Annual Reviews Inc., 4139 El Camino Way, Palo Alto, California 94306, USA), Price: USA $ 34, Elsewhere $ 38.

The present volume of the *Annual Review of Genetics*, in its traditional format, contains 22 chapters, all of them written by leading workers in their areas. Four of the articles are in the area of plant genetics, while nearly 10 of them deal with various aspects of mammalian genetics. The remaining articles are devoted to various other systems like phages, viruses and microorganisms, and specific molecular aspects.

The first review is titled 'Basic processes underlying *Agrobacterium*-mediated DNA transfer in plant cells' (P. Zambryski). While *Agrobacterium* can be routinely used as a vector to transfer DNA to plant cells, the 'biology' of the system presents a number of interesting problems. The aspects presented here pertain to the stages between plant cell recognition and transformation (which represent the T-DNA transfer process), comprising at least seven steps. The tomato is a favourite model system for both classical and molecular genetics (C. M. Rick and J. I. Yoder). It is a simple diploid; its twelve chromosomes have been well mapped. Several conventional and molecular markers are available and hereditary variations are easily detectable. Besides, excellent stock collections are available (germ plasm), and there are more such advantages. The molecular mechanisms regulating fruit ripening and developmental processes such as genesis of leaf shape, flower development, seed germination and stomatal behaviour are topics of current and future research using this system. In the article on maize developmental genetics (W. F. Sheridan), the central problem in the developmental biology of plants, viz. the role of genes in morphogenesis, is reviewed. Which are the genes and what mechanisms do they employ in directing and regulating morphogenesis from fertilization to embryo maturation, and from embryo germination to gamete formation are the major themes for discussion. The review entitled 'Foreign genes in plants: transfer, structure, expression and applications' (Weising, J. Schell and G. Kahl) examines the new insights into natural plant engineering and the impact of plant genetic engineering for basic gene research as well as crop improvement. An entire list of higher plant species transformed by gene transfer techniques has been provided here for ready reference.

There are two articles relating to sex determination and differential imprinting in mammalian systems. The article 'Mechanisms of X-chromosome regulation' (S. G. Grant and V. M. Chapman) discusses the molecular mechanisms governing the transition from single X expression in primordial germ cells and oogonia to an oocyte with two active X-chromosomes, and from embryonic cells with 2 active Xs to somatic cells with a single X. There are still many unresolved questions in this problem. It has become clear recently that mammalian development requires the functional presence of both maternal and paternal genomes. The relative importance of each gamete for subsequent development and the nature of interaction between gametes remain basic questions in developmental biology. Classical genetic analysis of meiotic nondisjunction, or manipulative techniques of nuclear transfer have revealed that some genes are differentially expressed, depending on whether they are contributed by the maternal or the paternal gamete. The possible mechanisms of differential expression are discussed by D. Solter in the article 'Differential imprinting and expression of maternal and paternal genomes'.

Mammalian genome organisation: an evolutionary view' (S. J. O'Brien, H. N. Seuanez and J. E. Womack) discusses the emergence of a cohesive picture of chromosome evolution in mammals. The application of molecular techniques to genetic analysis has provided composite genetic maps of several mammalian species including man. Today, about 3500 specifically localized markers on the human chromosomes are known, of which 1500 are functional genes. A 5–10-centimorgan human recombination map has been developed. A multidisciplinary 'genome' project designed to determine the entire DNA sequence of the human genome (approx. $3.2 \times 10^9$ base pairs) is on, and the latest timetable is to complete a 1–3-centimorgan linkage map in 3–5 years and a complete DNA sequence in 15 years. Technologies similar to those employed in human genetics have also been used to construct gene maps in several other mammalian species

(primates, rodents, carnivores and a few others like cow, horse, pig and sheep). The discovery of a powerful set of new tools for gene mapping by linkage based on the fact that informative genetic markers could be constructed with a combination of restriction enzymes and cloned DNA probes (RFLP technique) has revolutionized human genetics. The review entitled 'Sets of linked genetic markers for human chromosomes' (R. White and J. Lalouel) discusses DNA markers for the human genetic map, and the medical and forensic applications of maps of genetic markers. The latter aspect deals with both low-density and high-density mapping of genes that cause diseases; characterization of tumour chromosomes; and identification of perpetrators of crimes and biological parents, an important component of forensics. A review on tumourigenesis is provided by D. Hanahan. The development of a malignant tumour is a multistep process composed of a series of separable changes rather than a single deleterious change. The discovery of dominant transforming genes capable of inducing tumours following infection of animals or morphological transformation of animal cells *in vitro*, as well as the establishment of methods to transfer genetic information stably into the germ lines of laboratory mouse have provided powerful tools to investigate the consequence of expression of these genes on specific cells in the context of the whole organism. It is evident that inappropriate expression of a variety of oncogenes can result in the inevitable development of tumours and that there is an apparent specificity in oncoprotein action. One clear difference between tumours in humans and those in transgenic mice is that the former are often invasive and highly metastatic whereas metastasis is rare in tumours seen in transgenic mice.

There are four reviews covering the area of genetic disorders. 'Genetics of Duchenne muscular dystrophy' (R. G. Worton and M. W. Thompson) discusses the current understanding of this X-linked lethal disease that for many years was the most perplexing and frustrating disorder in clinical genetics. Prospects for understanding the disease changed dramatically after the gene responsible for Duchenne muscular dystrophy was mapped to a specific region of the X-chromosome and genomic sequences and cDNA clones were isolated. This was followed by the identification of dystrophin, the gene product of the normal allele. 'HLA disease associations: models for insulin-dependent diabetes mellitus and the study of complex human genetic disorders' (G. Thomson) discusses HLA and disease association as a model for the study of genetic disorders. 'Mendelian hyperphenylalaninemia' (C. R. Scriver, S. Kaufman and S. L. C. Woo) deals with the genetic and biochemical aspects of the syndrome in man. This disease can be prevented either by provision of a surrogate enzyme or by somatic cell gene therapy in phenylketonurea and by more effective cofactor therapy in certain types of phenylalaninemia. Families at risk will probably avoid the problem altogether by means of prenatal diagnosis and genetic counselling. According to these authors, genetics, medicine and society meet in hyperphenylalaninemia. In his review on aneuploidy, C. J. Epstein has covered the principles, precedents and experimental evidence guiding us in our search for the mechanisms. Aneuploidy is a frequent cause of mental retardation, congenital malformation and pregnancy wastage in humans. It also plays an important role in the pathogenesis of malignancy. Aneuploid conditions are the product of the simultaneous abnormality of multiple genes (two or many) and the phenotype is a consequence of the imbalance of several genes. They are manifestations of abnormalities of gene dosage; however, a mechanistic link has not yet been forged between any phenotypic feature of an aneuploid state and an imbalance of a specific locus.

Molecular and general aspects of recombination are presented in three reviews. The mechanism of conservative site-specific recombination (N. L. Craig) occurring within a short region of sequence identity shared by participating DNA segments by reciprocal exchange of strands by precise breakage and joining is contrasted with transposition, which occurs with accompaniment of DNA synthesis. Information on how the widely separated DNA sites communicate with one another and the chemistry of strand exchange is increasing. Recombination in prokaryotes, yeast and bacteriophage are covered in the other two reviews by T. D. Peters and C. W. Hill, and D. S. Thaler and F. W. Stahl, respectively.

One of the most important topics in genetics is the regulation of gene expression. In this area there are three articles in the current volume. 'Control of antigen gene expression in African trypanosomiasis' (E. Pays and M. Steinert) describes the strategy adopted by the parasitic microorganism to avoid the immune response of its host, of switching the expression of its surface antigens. A combination of two mechanisms intrinsic to the telomeric structures provides the parasite with an enormous variation

potential with the available repertoire of antigen genes. The review 'Spliceosomal snRNAs' (C. Guthrie and B. Patterson) describes the role of the small nuclear RNAs in splicing reactions, with the help of structural models and principles of alignment. Biological regulation by antisense RNA (review by R. W. Simons and N. Kleckner) has also attained importance in recent years because of the role of antisense RNA in control of plasmid copy number as well as in regulation of expression of specific genes. Again, this article is presented with structural models to make understanding easier.

The other review articles in this volume are 'The genetics of bovine papilloma virus type 1' (P. F. Lambert, C. C. Baker and P. M. Howley), 'Phylogenies from molecular sequences: inference and reliability' (J. Felsenstein) and 'Heat shock proteins' (S. Lindquist and E. A. Craig). Each of these reviews gives adequate coverage of the respective topics.

It is clear that the present volume covers a wide variety of topics. The fact that is most evident is that the concerted research efforts on the mammalian genome in the past few years have started yielding newer insights into such complex problems as sex determination, genetic imprinting, the molecular basis of tumorigenesis and genetic disorders. The book is an extremely useful one in any reference collection.

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