BOOK REVIEWS

Annual Review of Genetics Vol. 21, 1987, (ed.) Allan Campbell, (Published by Annual Reviews Inc., 4139, El Caminoway, Palo Alto, California 94306, USA), pp. 501, Price: USA $ 31, Elsewhere $ 34.

This volume is a collection of 20 articles dealing with diverse topics and organisms ranging from phages to humans.

There are 5 articles on DNA replication, recombination and methylation. The first one on Bacterial recombination by Joshua Lederberg is an autobiographical account of the major discoveries in recombination. He feels concerned about the fast disappearing scientific fraternity which contributed tremendously to his research growth.

The review on DNA methylation in *Escherichia coli* by M. G. Mornus deals with 3 methylase producing genes, *dam*, *dcm* and *hsd*. The role of the *dam* (DNA adenine methylation) gene in mismatch repair is well known. Discussed here is the regulation of gene expression by DNA methylases. Whenever a putative methylation site remains unmethylated in a *dam* mutant, for instance, that site becomes available for other functions, especially if the *dam* site is in a RNA polymerase binding region. Case studies of promotors, plasmid replication and initiation of DNA replication are reviewed in detail with reference to the *dam* and *dcm* sites within their RNA polymerase binding sites.

The third article is on 'Mechanism and control of homologous recombination in *E. coli*': This is restricted to the exonuclease V coding genes rec B, C and D, and their modes of recombination. It discusses unwinding of double stranded DNA by the rec BCD enzyme and its specific nuclease activity. The role of the chi site in promoting the RecBCD pathway is elaborated. A well-illustrated molecular model for the RecBCD pathway is presented at the end.

The article on Recombination in the T_4 phage, deals more with DNA replication, transcription and T_4 DNA packaging rather than directly dealing with recombination *per se*.

There is yet another article on DNA replication which deals with its regulation during development in the fruit fly *Drosophila melanogaster*. The replicon structure replication proteins and the mutants known for replication genes are described in fair detail. The emphasis is more on tissue and stage-specific DNA amplification and its regulation, taking well known examples of satellite DNA, rDNA and chorion genes.

There are three more reviews dealing with *Drosophila* developmental genetics in this volume.

The excellent review on the *Drosophila* alcohol dehydrogenase gene indicates that the search for a eukaryotic simile to the *E. coli* lacZ gene is over. Sofer and Martin in Analysis of ADH gene expression in *Drosophila* describe the newer strategies of reverse genetics used in *in vitro* mutagenesis of regulatory elements of the ADH gene and their re-insertion into embryos using transposable elements, to recover tissue specific enzyme activity. The authors recommend plasmid-mediated somatic DNA transformation (ST) as against the routinely performed germline transformation.

The *bithorax* gene complex of *Drosophila* never fails to create sensation, in the field of genetics of body organization. Although the article, with a very matter of fact title '*Bithorax* complex' by Ian Duncan requires a basic knowledge of the *Bx* complex genes and the morphology of mutant flies; it provides an excellent update on the subject. The molecular genetics of the 3*Bx*-C domains *Ubx*, *abdA* and *AbdB* are discussed in detail. Included also are results from latest papers on the localization of the Homebox containing *Ubx* gene product to nuclei, confirming that *Hox* is a DNA binding protein. The transvection phenomenon within the Bx-C is dealt with very well.

A very short article on 'Genetics of biological rhythms in *Drosophila*' is actually about the molecular genetics of only a single gene locus-*period* which causes arrhythmic eclosion in the fruitfuly. The *per* gene product is shown to code for a peptidoglycan, the 'driving site' of which, is probably the brain. It is hypothesized that the attainment of a threshold of the *per* gene product determines the end of the first half of a 24 h circadian rhythm cycle. Evidence supporting it is the enhanced activity and thereby early threshold attainment in a hyperactive *per* mutant, where the cycle becomes shorter and hence is faster.

There is a related article on Behavioural genetics of *Paramecium* which deals with the genetics and the molecular biology of voltage sensitive channels for Ca^{2+} and K^+ ions. Both subtle genetic and straightforward molecular biology techniques are described. The cloning and identification of the highly conserved Ca^{2+} binding protein calmodulin in the *panthophobiac* mutant are reviewed with special

reference to its Ca^{2+} binding domain and its relation to the Ca activated K current.

An article of general nature by E. M. Meyerowitz on *Arabidopsis thaliana* announces the arrival, so to speak, of the *Drosophila* of the plant kingdom. With a total genome size of 70,000 kb (only 5 times that of yeast) and with a well worked out genetic and cytogenetic map, it is now possible to clone any gene for which a mutant and a genetic map position are known. This makes the bleak prospects of the molecular genetics of higher plants somewhat bright.

The article on Sex determination and dosage compensation in *Caenorhabditis elegans* reviews the available information on the seven major sex determining genes in this nematode. The epistatic relationships among these genes are presented to reveal the pathway of gene action. Sex differentiation takes place after determination, under panoply of differentiation genes, some of which are also involved in dosage compensation of X-linked genes. Because of the thorough understanding of the fate of virtually every single cell, *C. elegans* probably holds the key to understanding some of the deeper biological questions of sexual organization and evaluation.

The review on The genetics of active transport in bacteria by H. A. Shuman deals with the genes involved in lactose and maltose transport in *E. coli*, with energy coupling reactions, structure and topology of membrane components and substrate recognition.

The volume also carries two related articles on the regulation of gene expression. The first on Alternative promoters in developmental gene expression deals with the gene regulation, spatially and temporally by more than one promoter. It gives a broad and general view on the presence of alternate promoters, taking examples of the ADH, *caudal* and *Antennapaedia* loci of *Drosophila* and the rat amylase genes. The second article is on the termination of transcription elongation and termination in pro-eukaryotes and eukaryotes.

In a closely related review of Regulatory proteins in yeast by L. Guarenta, the biochemistry and genetics of three known *cis* acting elements of yeast promoters, the initiation, the TATA box and the operators are discussed.

The surest and the most straightforward way to connect the functions of proteins *in vivo* to their activities *in vitro*, is through mutations' states, one of the introductory paragraphs in the article on the yeast cytoskeleton. And mutants it is all the way, for all the proteins of the cytoskeleton like B tubulin, alpha tubulin and actin that have been identified and studied.

The review by T. D. Fox on Natural variation in the genetic code discusses the codon assignments of the mitochondrial DNA of all evolutionary groups of organisms. It is of interest to note that there are some nonsense codons that are specific to some genes and are used as sense codons for incorporating modified amino acids. This is seen in the *fdh* F gene coding for Selenoprotein formate dehydrogenase in several organism, throughout the evolution where the nonsense codon UGA incorporates the modified amino acid Se-Cystine.

A somewhat related review is on the Origin of species in a deme. It deals with how genetic variability (largely through mutations) is recombined, processed and selected for perpetuation. The recent use, of molecular analysis of plant and animal genomes in elucidating the behaviour of adaptively important genes is discussed.

There is one more article on population genetics, although of a historical nature, dealing with the authors' own views on the personal contributions of population geneticists–past and present.

Finally there is the review on Oncogene activation by chromosome translocation in human malignancy. Molecular genetic mechanisms involved in the activation of oncogenes are discussed here. Ever since the seminal discovery, that chronic myelogenic leukaemia in man is associated with a translocation, it has been shown that several malignancies exhibit non random chromosomal abnormalities.

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