Heredity **64** (1990) 427-431

Book Reviews

The eukaroyte genome in development and evolution. B. John and G. Miklos. Allen and Unwin. 1988. Pp. 416. Hard Back, £40. Paper Back, £14.95. ISBN 0 04 5750327 HB, ISBN 0 04 5750335 PB.

This unquestionably is an important book. In the first place it embodies a vast amount of information about the advances in knowledge about the organisation and activity of genetic material resulting from the application of molecular methods of investigation during recent years. In the second place this information is presented, collated and interpreted with clarity and imagination.

The contents fall into two main sections reflecting the title. In the first section are chapters on the structure and organisation of genomes, their coding capacities, their activities during growth and development. Much of the detail relates to *Drosophila* for the very good reason that most of the information, particularly with respect to development, derives from work on that genus. The second section deals with genome changes in relation to evolution and speciation and with the origin of morphological novelty.

In the first chapter are brief descriptions of the experimental procedures employed by molecular biologists for investigating the organisation of genetic material and the products of its expression. This will be much appreciated by many biologists interested in the subject matter but who are unfamiliar with the molecular techniques. What these techniques have revealed about genome structure and genome change makes for an astonishing contrast with the beliefs and assumptions of twenty years ago. From the evidence amassed we must accept that much of the eukaryote genome is comprised of material that is non-coding and untranscribed. In *Drosophila melanogaster* about two-thirds of the chromosomal DNA is of this nature; only a third, about 55 million base pairs, may be described as "genic". Moreover it is the non-coding fraction in a wide range of eukaryotes which is most subject to variation during development and evolution. In both instances the variation displayed is often spectacular. During development familiar examples are the loss of heterochromatin in polytene nuclei of *Drosophila* and the shedding of some 70 per cent of the chromosome material from somatic cells during early cleavage in *Parascaris univalens*. As the authors point out, such gross and readily distinguishable genome change in conjunction with differentiation is rare and, moreover, of questionable significance in the control of development. It is well nigh impossible to distinguish cause from effect. The same most certainly applies to genome change associated with evolutionary divergence and speciation. Change in chromosome number and structure, in genome size and organisation bear little relation to form and function such that there is "no clear correlation between the size of the genomic perturbation and the size of the phenotypic perturbation". In retrospect the endeavour to relate genome change to change in phenotype is of course understandable. After all every change in phenotype must ultimately reflect change in the genome. Not all changes in the genome, by any means however, impinge directly upon the phenotype. It is for this reason that karyotype studies have often proved to be less than useful to the taxonomist.

Genome changes which influence the development of the phenotype in adaptive fashion will be fixed by selection. The other less "meaningful" changes the authors attribute to inevitable enzymic events affecting the DNA turnover, its capacity for amplification, its reorganisation under the influence of transposable elements and, given much emphasis, homogenisation of the DNA sequences within a population by molecular drive.

Turning to the subject of the origin of morphological change the problem is to identify those changes in the genomes which effect significant alterations in developmental pathways. These may and probably do constitute changes of small degree relative to the often massive changes manifested by the genome. The authors suggest concentration upon changes which affect the timing of gene expression and upon the creation of switch genes generating alternative pathways in development. Such genes, acting early in development may reflect small alterations in the genome itself and, as such, that much more difficult to identify. Such an approach towards understanding how morphological change originates is well enough, considered from the exclusive standpoint of the geneticist. What is stressed in the final chapters is that the developmental process embraces many mechanisms which involve the action and interaction of the products of gene expression at many different and distant levels of organisation; mechanisms which include the interactions between cells, factors which determine the movement and distribution of cells as the embryo develops. In short the resolution of the problem requires more than falls within the province and the capacity of the mere geneticist. Finally, the authors question the long established premise that the evolution of each and every aspect of the phenotype must necessarily be "explained" in terms of adaptation and function. One may disagree. Be as it may this is a book to be recommended in the strongest terms.

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