Book review

Many, G. S. (ed.): Lecture Notes in Biomathematics, 53. Evolutionary Dynamics of Genetic Diversity. Proceedings, Manchester 1983. Berlin, Heidelberg, New York, Tokyo: Springer 1984. vii + 312 pp., several figs. and tabs. Soft bound DM 44,–.

The search for explanations of the causes for the high genetic diversity observed in natural populations still seems to inevitably lead to a controversial discussion of the significance of selective versus neutral factors in evolution. With one exception, this phenomenon recurs in all contributions contained in the volume entitled 'Evolutionary Dynamics of Genetic Diversity', edited by G. S. Mani. The exception is provided by C. Wills, who proposes that stress-triggered evolution is an explanation for discontinuous evolution. He concludes that environmental stress may cause internal, co-evolved mutagenic agents, such as viruses or plasmids, to trigger major genomic changes and argues that external, autonomous agents are less likely to generate such drastic changes.

The remaining four contributions included in these proceedings of a symposium on 'The Basis of Genetic Diversity' held in Manchester, 1983, discuss the selectionist-neutralist controversy with the help of evidence supported by speculative, experimental or model-based considerations.

L. M. Cook advocates the idea that selection may only temporarily become effective. Since selection may generally be expected to be density regulated, it is relaxed under ameliorated conditions, while it increases otherwise. The author concludes that, therefore, only few mutants are likely to escape selection indefinitely.

This interesting idea is picked up by G. S. Mani and cast into a model based on the diffusion approximation. The model considers the effects of density dependent selection, mutation and finite population size on a single, multiallelic locus. The objective is to explain the variation of heterozygosity with population size and the variation in genetic diversity with ecological factors. The simulation studies yielded results, some of which are the opposite of the predictions of the neutral model; for example, selection becomes weaker with increasing population size. This is also difficult to evaluate in terms of Cook's suggestion.

By far the most voluminous article (about 2/3 of the volume) is contributed by E. Nevo et al. They present an analysis of a very impressive compilation of enzyme data, which are classified with respect to 7 ecological, 5 demographic and 9 life history characteristics and which represent 1111 species ranging over a number of taxa. Moreover, the article includes a comprehensive overview of the relevant literature, comprising both experimental and theoretical work. The adaptive significance of enzyme polymorphisms is inferentially demonstrated by associating two genetic indices with the above biotic characteristics. These indices are the population average of the proportion of heterozygous loci per individual (heterzygosity H) and number of polymorphic loci in the population (genetic diversity P). From the extensive correlative statistical analysis, the hypothesis is inferred that environmental heterogeneity (and thus ecological characteristics) is a major factor in maintaining and structuring genetic diversity in natural populations. Thus the data 'strongly suggest that levels of enzyme diversity, far from being mostly neutral, contain a substantial amount of adaptive differentiation by natural selection'. Unfortunately, Nevo et al. do not discuss the significance of their P as a measure of genetic diversity. The usual measures which reflect the number of genes and their frequencies might have been more suitable for displaying the role played by heterozygosity for the maintenance of genetic polymorphisms.

To M. Nei 'it now seems clear that the population dynamics of protein polymorphisms is largely controlled by the stochastic factors whether some weak selection is involved or not', and he believes 'that mutation is the driving force of evolution, and natural selection plays a secondary role'. The author finds support for his statements in the fact that the observed heterozygosity is less than expected under the neutral hypothesis. Here, the term 'heterozygosity' is actually defined as a measure of genetic diversity in the above mentioned sense and is, therefore, different from the H as well as from the P used by Nevo et al. Nevertheless, Nei contrasts his conclusions with those of Nevo et al. on the basis of 'heterozygosity', which makes it difficult to follow his reasoning.

In summary, the present volume mirrors the selectionist-neutralist dilemma in various of its facets, some of which seem to be of a methodological nature and others of which are to be found in the formulation of the models underlying the predictions. However, the volume also contains new suggestions for resolving at least some aspects of the dilemma.

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