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POPULATION-GENETICS AND MOLECULAR EVOLUTION - OHTA,T, AOKI,K

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TOMOKO OHTA and KENICHI AOKI, editors, *Population Genetics and Molecular Evolution*, Tokyo, Japan Scientific Societies Press, 1985, pp. xvii + 503, illus. (no price stated).

Hereditary variation is a necessary condition for evolution by natural selection, as Darwin saw it. Moreover, the more genetic variation that exists in a population, the greater the opportunity for evolution to occur. This was mathematically demonstrated in 1930 by the British geneticist R.A. Fisher in his 'fundamental theorem of natural selection', and it has been corroborated experimentally.

But genetic variation may be a mixed blessing. Assume that alternative gene variants exist with respect to some trait, and that they persist because they are beneficial with respect to some or other aspect of the environment. (The gene variants might differ with respect to different foods in the case of an animal, or different soils in the case of a plant; or their beneficial effects might vary with the yearly seasons). The population would then consist of individuals some of which would not possess the optimal genetic constitution in a particular place or time. Genetic variation entails a genetic 'load', the reduction in the average fitness of the population because not all organisms possess the 'best' genotype in every place at all times.

Some evolutionists in the 1940s and 1950s maintained that genetic variation must be restricted to a small fraction of all genes. Otherwise, they argued, the genetic load would be so large that populations could not survive. The distinguished geneticist and Nobel laureate H.J. Muller was the champion of that position. Students of natural populations, however, unraveled what seemed virtually unlimited genetic variability and proposed that the genetic load argument was fallacious. The great evolutionist, Theodosius Dobzhansky, championed this position since the 1940s.

The advent of molecular biology made possible in the 1960s to obtain quantitative estimates of genetic variation. It became definitely established that genetic variation is

pervasive, even more so than had earlier seemed apparent to Dobzhansky and other students of natural populations. The evidence was a definitive blow to the hypothesis of Muller and others proposing that genetic variation is very restricted. Their conclusion was abandoned, but not the genetic load argument that had theretofore been used to buttress the conclusion. In 1968, the Japanese Motoo Kimura proposed an explanation: most of the genetic variation detected at the molecular level is neutral with respect to natural selection; i.e., the genetic variants do not affect the fitness of the organism and, hence, do not generate any genetic load. This hypothesis became known as the Neutral Theory of Molecular Evolution and has had ever since an enormous impact in evolutionary and population genetics studies. The stimulus provided by the Neutral Theory was due in good part to its brilliant mathematical simplicity. Kimura derived very simple equations that predicted amounts of genetic variation and rates of evolution as functions of very few parameters, such as the size of the population and the mutation rate of genes.

Population Genetics and Molecular Evolution derives from an international symposium held in November 1984 at the Institute of Genetics, in Mishima, Japan, to celebrate Kimura's sixtieth birthday. There is little that is scientifically new in this volume, but there are few other books gathering so many good papers on the mathematical theory and the experimental evidence of molecular evolutionary and population genetics. A majority of participants are Japanese, but there are distinguished contributors from other parts of the world. The scope of the book is broad. I see no reason to enumerate the topics, much less to list the contributors or their titles, but will call attention to Kimura's brief 'memoir', engagingly written and full of details of his personal history. The memoir is not particularly enlightening towards discovering the grounds of Kimura's greatness, but it is modulated with a sensitivity and warmth that are hardly apparent to those of us who know him only professionally.

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