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This Week's Citation Classic

Selander R K & Johnson W E. Genetic variation among vertebrate species. *Annu. Rev. Ecol. Syst.* **4**:75-91, 1973. [Dept. Zoology, Univ. Texas, Austin, TX]

The acquisition by evolutionary geneticists of electrophoretic and other techniques for demonstrating allelic variation at loci encoding polypeptides permits a new and extensive examination of variation in populations and of genetic differences between races and species. [The *SCI*® indicates that this paper has been cited over 110 times since 1973.]

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"This review of what had been discovered about the genetics of natural populations of vertebrates by the application of electrophoretic methods to the study of protein polymorphisms was originally written for the XVII International Congress of Zoology, which met in Monaco in 1972. When plans for publishing the symposia of the Congress fell through, Richard F. Johnston, the editor of *Annual Review of Ecology and Systematics (ARES),* agreed to publish our contribution, provided it could be reduced in length by half. We finally got it down to 17 printed pages, and it appeared a few months later, thereby confirming Chargaff's rule that any paper written in biology ultimately is published.

"The review is unusually short and succinct for a contribution to *ARES,* being, in fact, a kind of 'Reader's Digest' of a number of long and rather boring, data-filled papers. Conclusions relating to a variety of subjects and problems are stated with little or no qualification or ambiguity.

"Electrophoresis was introduced to population biology in 1966; and by 1973, many studies had been completed, particularly on *Drosophila* and, largely in our laboratory, on rodents, lizards, and other types of vertebrates. Yet at that time there were no comprehensive reviews to tell the general reader what electrophoresis was contributing to population genetics. A year later, Richard C. Lewontin critically reviewed all the evidence on the nature of genetic diversity among organisms,[1] and two other books on molecular evolution appeared in the next two years.[2,3]

"In our review, we summarized evidence indicating that (1) most populations of vertebrates are polymorphic at thousands of structural gene loci, and that vertebrates are genetically less variable than invertebrates; (2) variation is often reduced in populations inhabiting islands and caves, apparently as a result of genetic drift; (3) some enzymes are polymorphic in most species, while others are rarely variable, and there is no difference in variability between glucose-metabolizing and other enzymes; (4) sampling drift is an important factor in the microgeographic structuring of populations of house mice and other species; (5) interpretations of geographic variation in allele frequencies are likely to be unsatisfactory if based solely on correlations with environmental factors; and (6) molecular data can be used to estimate amounts of genetic divergence between populations, semispecies, and species, and should have major application in systematics. We also featured the recent work of Vincent M. Sarich, Allan C. Wilson, and Masatoshi Nei on evolutionary protein clocks.

"In sum, our paper briefly reviewed the major lines of investigation then being pursued by students of molecular population genetics and indicated what effect these studies were having or might have on evolutionary biology and systematics. In retrospect, it is apparent that most of the major conclusions that have emerged from electrophoretic studies were already apparent in 1973."

1. **Lewontin R C.** *The genetic basis of evolutionary change.* New York: Columbia University Press, 1974.
2. **Nei M.** *Molecular population genetics and evolution.* Amsterdam: North-Holland, 1975.
3. **Ayala F C,** ed. *Molecular evolution.* Sunderland, MA: Sinauer, 1976.