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This Week's Citation Classic

Selander R K, Hunt W G & Yang S Y. Protein polymorphism and genie heterozygosity in two European subspecies of the house mouse. *Evolution* **23**:379-90, 1969. [Dept. Zoology, Univ. Texas, Austin, TX]

Danish populations of the house mouse *(Mus musculus)* were polymorphic at 17 of 41 structural gene loci assayed electrophoretically, and individuals were heterozygous at 8.0% of their loci. Evidence that two subspecies or semispecies differ at 32% of their loci supported Ernst Mayr's theory that major reorganizations of gene pools accompany the speciation process.[1] [The *SCI*® indicates that this paper has been cited over 135 times since 1969.]

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"In 1967 I was at the University of Texas (Austin), working in collaboration with Richard Johnston, of Kansas, on changes in color and size that had developed in the introduced house sparrow. My student Suh Yang had studied grackles, and we were frustrated because we could not translate phenotypic variation into genetic variation. So we decided to become geneticists and study evolution by using electrophoretic methods of detecting protein polymorphism that had been introduced by Richard Lewontin and Jack Hubby in 1966.[2] The transition from ornithologist to geneticist was easy because Wilson Stone, Ken Kojima, and Frank Johnson were electrophoresing *Drosophila* at Texas. We were soon getting data on polymorphisms in hemoglobin and esterases from local populations of the house mouse, which we chose to study because it is common and breeds in captivity, and we ended up electrophoresing 12,000 mice in the next two years.

"This was before molecular population genetics became complicated and polarized into 'neutralists' and 'selectionists.' We had a technique for examining primary gene products and were sufficiently naive and enthusiastic to believe that the major genetic problems of evolution could now be solved.

"The work published in this paper was done in March of 1969, by which time Yang and I had recipes for 'staining' 36 enzymes on starch gels. Meanwhile, I had convinced Grainger Hunt, a graduate student, that mouse genetics was more interesting than falconry and had sent him to Jutland to study two forms of house mice hybridizing in a narrow zone. When he returned to Austin with 3,000 specimens, we had a chance to estimate the amount of genetic change involved in speciation. We actually used only 99 of Hunt's mice (he later studied them all[3]), but we 'scored' 41 loci.

"There are several reasons why this paper has been frequently cited. By asking several good questions and getting unequivocal quantitative answers, based on an impressive number of loci, we showed how electrophoresis might be used in solving some long-standing evolutionary problems. We confirmed Mayr's theory that large genetic differences accumulate before reproductive isolation between species is complete, and we found support (or thought we had) for the idea of genie coadaptation. This was the first comparative study dealing with polymorphism at specific loci, and we employed a coefficient of genetic similarity to summarize our data, which were later used by others in developing new coefficients. We also presented the first estimates of levels of polymorphism and heterozygosity in an organism other than *Drosophila* and man. Although ours was a new type of paper for *Evolution,* it was intelligible to most readers because it dealt with an animal that everyone knows and concerned a textbook case of hybridization, thus tying in with older literature and theory. By publishing ten more papers on house mice, we called attention to the first, which is often cited when others should have been."

1. **Mayr E.** Change of genetic environment and evolution. (Huxly J, Hardy A C & Ford E B, eds.) *Evolution as a process.* London: George Allen & Unwin, 1954. p. 155-80.
2. **Lewontin R C & Hubby J L.** A molecular approach to the study of genie heterozygosity in natural populations. II. Amount of variation and degree of heterozygosity in natural populations of *Drosophila pseudoobscura. Genetics* **54**:595-609, 1966.
3. **Hunt W G & Selander R K.** Biochemical genetics of hybridisation in European house mice. *Heredity* **31**:11-33, 1973.