

This Week's Citation Classic

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Sokal R R & Sneath P H A. *Principles of numerical taxonomy*.
San Francisco, CA: W.H. Freeman, 1963. 359 p.
[Dept. Entomology, Univ. Kansas, Lawrence, KS and
National Institute for Medical Research, London, England]

Numerical taxonomy establishes classifications of organisms based on their similarities. It bases classifications on many equally weighted characters, unaffected by subjective or phylogenetic judgments, and employs clustering algorithms applied to similarity matrices. Its methods can be applied in many fields besides biological classification. [The SCI® indicates that this book has been cited in over 1,280 publications since 1963.]

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"I became converted to statistical approaches in biology by Sewall Wright and Clyde P. Stroud while a graduate student at the University of Chicago. As a new assistant professor at the department of entomology at the University of Kansas, I in turn attempted to convince my colleagues and students of the value of statistics in biological research. This led me one day in 1953, during a casual bag lunch in the laboratory when the conversation had turned to theory and practice of taxonomy, to make the brash claim that I could do a better job of classifying organisms by statistical means than by the traditional subjective approach. This view was challenged and before I knew it Earl A. Bell had bet me a six-pack of beer (then as now only 3.2 percent in Kansas) that it could not be done. Charles D. Michener agreed to furnish data on a group of bees and I started developing approaches initially based on early developments of cluster analysis in psychology. The result was the first modern paper on numerical taxonomy in North America.¹

"At the same time, P.H.A. Sneath, a young medical researcher with the Medical Research Council in London, revising the bacterial genus *Chromobacterium* for his Cambridge University doctoral dissertation, decided that traditional methods of grouping the numerous strains and species were in-

adequate, and developed techniques that independently led him to quantify similarities between taxa and to cluster the resulting similarity matrices. His work was published a few months before mine.² Sneath learned about the work at Kansas before its publication from the virologist C.H. Andrewes, an amateur entomologist, and wrote telling of his own studies. From this initial contact grew a collaboration and personal friendship which has resulted in this book, a later book reviewing the field,³ and several other joint papers. Numerical taxonomy developed rapidly aided by the simultaneous introduction of digital computers into universities.

"The frequent citation of this book has three main reasons. Our book was the first to enunciate the principles and to detail the methodology; in fact, we coined the name 'numerical taxonomy.' Most of the increasingly numerous publications that applied the techniques up to 1973 would cite the book as a reference for methods or principles used. Furthermore, since its very beginning, numerical taxonomy has engendered controversy. Many of the citations are indeed critical. Finally, the wide applicability of numerical taxonomy makes this a book referred to in papers ranging as widely as archaeology, psychology, medicine, economics, and even the humanities.

"Numerical taxonomy in recent years has changed to include numerical methods for estimating evolutionary branching sequences. It is still embroiled in controversy.⁴ The methods have profoundly altered some taxonomic practices including numerical methods of identification. The principles, although still controversial, have at the very least had an important effect in clarifying and crystallizing views of opposing schools of taxonomy.

"The work developed in this book ultimately led to the various honors that have been bestowed on us: an honorary doctorate from the University of Ghent (Sneath); honorary memberships in the Society for Systematic Zoology (Sneath, Sokal) and the Linnaean Society (Sokal); and society presidencies—the Systematics Association (Sneath), the Classification Society (Sneath, Sokal), the Society for the Study of Evolution (Sokal), and the American Society of Naturalists (Sokal)."

1. Michener C D & Sokal R R. A quantitative approach to a problem in classification. *Evolution* 11:130-62, 1957.
2. Sneath P H A. Some thoughts on bacterial classification. *J. Gen. Microbiol.* 17:184-200, 1957.
3. Sneath P H A & Sokal R R. *Numerical taxonomy*. San Francisco, CA: W.H. Freeman, 1973. 573 p.
4. Rohlf F J & Sokal R R. Comparing numerical taxonomic studies. *Syst. Zool.* 30:459-90, 1981.