

appeal for the scientist, Hertz scholar, and historian of education. The diaries and letters paint lively vignettes of German education in the 1870s and 1880s. Among many others, for example, are depictions of Hertz's routine as an apprentice-engineer in Frankfurt, of the formalities of his Berlin doctor's examination with its round of preliminary visits, and of his private visit to the Prussian minister of education, in which the now famous young professor fought to make room for his own personal preferences as the minister instructed him on which university chairs to refuse and which to consider. Again, the story of his relation to his science, emerging from this record through the medium of Hertz's sensitive self-scrutiny, is moving and wonderful. The lengthy, urgent letter in which the twenty-year-old student both begs and demands his parents' acquiescence in his decision to change his course of studies from engineering to physics is a highlight.

JOAN BROMBERG

428 Girard Street  
Gaithersburg, Maryland 20760

C. C. Heyde; E. Seneta. *I. J. Bienayme: Statistical Theory Anticipated*. (Studies in the History of Mathematics and Physical Sciences, 3.) xiv + 172 pp., bibl., index. New York/Heidelberg/Berlin: Springer-Verlag, 1978. \$19.80.

I. J. Bienaymé (1796–1878) is an engaging but obscure figure in the history of statistical theory. He was a prominent man in his own time, first as a French government official and then as a member of the Academy of Sciences. But he is scarcely remembered today. Of his many contributions to probability and statistics, only one has had lasting influence, and it is usually called Chebyshev's inequality.

Heyde and Seneta, two modern workers in the theory of stochastic processes, uncovered a few years ago what is surely the most puzzling of Bienaymé's achievements. In 1845 Bienaymé published, without proof, a flawless statement of the criticality theorem for branching processes: eventual extinction of a family name has probability one if and only if the mean number of male children is one or less. This theorem was rediscovered only in this century, many years after Galton and Watson (1874) falsely asserted that extinction always has probability one. Heyde and Seneta were so intrigued by their discovery that they

resolved to see what other treasures of Bienaymé's the world has overlooked. The result is this book—an exhaustive account of Bienaymé's work and an attempt to use it to gain a perspective on the overall development of statistical theory in the nineteenth century.

Parts of the story are quite interesting. We do indeed understand nineteenth-century statistics better after we have seen Bienaymé criticizing Poisson's law of large numbers, squabbling with Cauchy over the importance of Laplace, and obtaining simultaneous error estimates for least squares. The authors' reconstruction of Lexis' theory of dispersion is also instructive. Some other parts of the story will interest only those who share the authors' enthusiasm for Bienaymé. Readers should also be warned that the authors allow this enthusiasm to lead them to some remarkable conclusions about the extent to which Bienaymé anticipated modern ideas.

GLENN SHAFER

Department of Mathematics  
University of Kansas  
Lawrence, Kansas 66044

Robert H. Kargon. *Science in Victorian Manchester: Enterprise and Expertise*. xi + 283 pp., bibl., index. Baltimore/London: Johns Hopkins University Press, 1977. \$16.

It is a pleasure to meet a survey of the evolution of scientific institutions in Manchester which makes a genuine contribution to our understanding of Victorian social history. Kargon achieves this by making his historiographical goals explicit within a functionalist framework. It is his concern to illuminate the nineteenth-century transition from amateur to professional science within the context of an emerging and rapidly changing urban industrial community. In Kargon's view this transition is underlaid by another, a changing perception on the part of both scientists and laymen of the nature and function of science: an emergent view that science could be both produced at will and applied systematically—hence the enterprise and expertise of the subtitle.

To focus the discussion of such wide-ranging issues, Kargon offers the reader a typology organized around the gradually changing social role of science in Manchester as understood by investigating its scientific practitioners and institutions in various periods. He begins with the gentleman-amateur tradition and the embodiment of science as a