Book Reviews

Efforts at Quantification

American Medicine and Statistical Thinking, 1800–1860. JAMES H. CASSEDY. Harvard University Press, Cambridge, Mass., 1984. xiv, 306 pp., illus. $22.50.

Statistical thinking, ubiquitous as it is today, is a relatively recent phenomenon in Western thought. Historians of statistics have identified the early 19th century as the period when a popular enthusiasm for counting and calculating first took hold in America. The effects of the enthusiasm were manifested in politics, economics, social reform, religion, and public health. It is an often noted but not well-explained fact that many of the most avid quantifiers of the 19th century were medical doctors, whose interests in statistics often extended beyond the medical realm and who were prominent among the founders of professional statistical societies. James Cassedy of the National Library of Medicine has written a book that focuses on the intersection between the history of medicine and the history of statistics in the formative years from 1800 to 1860.

According to Cassedy, medicine before the early 19th century was not very empirical. A priori theories of disease dictated therapeutic approaches. For example, the theory that all disease stemmed from an excess of pressure in the blood vessels led doctors like Benjamin Rush to rely on bloodletting and purging as magical cure-alls. However, some practitioners were increasingly dissatisfied with the vagueness of medical theories and uncertain results of therapies. They turned instead to a Baconian model of theory-building that proceeded through experiment, observation, measurement, and inductive reasoning. Close observation and detailed fact-gathering, it was thought, would naturally yield up patterns pointing to true medical knowledge. The best sort of fact, of course, was a numerical fact, for it was objective, precise, and certain.

But what aspects of medical practice were quantifiable? What sort of bodily fact was susceptible to measurement? On a patient-by-patient basis, quantification did not appear particularly appropriate—the days of measuring temperature, pulse, lung capacity, and blood pressure three times daily lay far in the future—and so statistically minded antebellum doctors turned to patient records in the aggregate.

The idea of maintaining clinical records of patients was itself novel in the early 19th century, Cassedy tells us. Doctors' case records often consisted at most of notes of debts. Now proponents of the "numerical method of medical analysis" insisted on detailed clinical records, arguing that memory tended to be selective and that bad or fatal outcomes of therapies were often conveniently forgotten. Aggregate patient records were the only sure way to evaluate the proper course of medical treatment. By the mid-19th century there were record books ready-made with ruled columns for entering demographic characteristics, symptoms, medications, and outcomes for each patient. The aggregate records were supposed to illuminate the causes and cures of all diseases. However, the understandable reluctance of some practitioners to record and make public their failed cases was a recurring obstacle.

Cassedy also describes the uses of aggregate patient records by health reformers to prove the dire consequences of various bad habits like drinking, and by institutions such as hospitals and asylums, which found cure-rate figures to be a handy and persuasive way to assure continued funding from state legislatures.

One of the strengths of this book lies in Cassedy's attention to the chains of influence that fostered the development of statistics in medicine. Two chapters recount the development of mortality statistics and vital registration systems as tools of a growing public health movement, and Cassedy traces the inspiration for this kind of statistical thinking directly to the sanitary reformers of England. He also identifies the French doctor Pierre Charles Alexandre Louis as perhaps the central source of the "numerical method" in American medicine; a coterie of influential American medical students took their training under Louis in Paris in the 1830's and 1840's and had drilled into them the importance of meticulous hospital records. Cassedy is able to show that these men and their own subsequent students were the chief sponsors of statistical thinking in orthodox medicine in America.

Among the unorthodox and irregular medical practitioners of the antebellum period there were many who also shared the enthusiasm for numbers, and Cassedy devotes several chapters to the variety of medical sects whose leaders invoked numbers in an effort to establish their scientific credibility. Homeopaths, botanists, hydropaths, and other eclectics flourished, much to the dismay of the orthodox doctors. Some of the irregulars criticized the orthodox doctors for their mountains of useless statistical data, but then they amassed some of their own, for example the cure-rates for visitors to certain water spas or the quantities, in tons, of dangerous calomel sold in Cincinnati over a three-year period.

Cassedy has ranged far and wide in the medical literature of the 19th century to ferret out many hundreds of such examples of the uses of numbers in medicine. The footnotes, purposely pruned of all secondary sources, constitute an invaluable and extensive list of everything even remotely numerical in medicine between 1800 and 1860. But this virtue of comprehensiveness at times overwhelms and even obscures the main thesis of the book.

Cassedy has deliberately chosen not to discuss the merits and limitations of the medical statistics he uncovers; he acknowledges in the preface that many of the data collected were faulty, crude, and suspect, and he lets it go at that. His mission is to amass a descriptive catalogue of occasions when numbers were used, not to critique it for its naïveté and bias.

What this means is that many rather distinct uses of numbers are presented as if they were manifestations of the same general numerical mentality. A statistical study of amputations, a "moral thermometer" that assigns numerical values to temper and moods, and a concern for incredibly exact measurement of medicine doses all do indeed involve numbers—but there the similarity stops. The first is a foray into simple but real statistical thinking, using past cases to predict probable outcomes in amputation operations, but the second is a bogus use of numbers to lend the aura of science to a dubious enterprise and the third is an exercise in precision.

Cassedy ends his study in 1860, for he finds that by the second half of the 19th

century the "numerical method" was increasingly under fire. The Baconian promise of knowledge through inductive methods had not really panned out, and the very limited mathematical techniques underlying medical statistics further obstructed progress. Medical research moved into laboratory work, and the devotion to numbers for numbers' sake waned. Cassedy's book affords us a look at an era when our culture's romance with numbers began; his impressive amount of evidence will surely spark further explorations into the origins of statistical thinking.

PATRICIA CLINE COHEN
Department of History, University of California, Santa Barbara 93106

The Southern Sky

Surveys of the Southern Galaxy. W. B. BURTON and F. P. ISRAEL, Eds. Reidel, Boston, 1983 (distributor, Kluwer Boston, Hingham, Mass.). xiv, 309 pp., illus., + appendixes. $46. Astrophysics and Space Science Library, vol. 105. From a workshop, Leiden, Netherlands, Aug. 1982.

Dutch astronomers have a gift for convening small international meetings on developing topics that often lead to breakthrough contributions to our knowledge of galactic structure and stellar evolution. *Surveys of the Southern Galaxy* contains an exciting account of such a conference.

Since 1960 the long-standing neglect of the skies above southern latitudes has been counteracted quite splendidly by the installation of major astronomical observatories in Chile, Australia, Africa, and Argentina. Indeed, the former "hidden quadrant" of the Milky Way galaxy, which cannot be observed from northern obervatories, is increasingly well studied and mapped at these excellent new sites.

Molecular clouds are aggregates of gaseous matter with a little bit of dust added. Their diameters extend for some 90 light-years, and their masses are equal in some cases to about a million solar masses. In these clouds we observe the most abundant molecule, hydrogen, along with carbon monoxide, cyanogen, ammonia, and some 60 other molecules—enough to stock the shelves of any respectable cosmic chemist. Carbon monoxide appears to be the best tracer over wide areas; carbon sulfide is an excellent indicator of density in the clouds. Almost all of the lines and bandheads can serve as indicators.

Molecular clouds form the basis for most of the research discussed in *Surveys of the Southern Galaxy*, and surveys of carbon monoxide receive special attention and emphasis. A report by B. J. Robinson, W. H. McCutcheon, R. N. Manchester, and J. B. Whiteoak on a survey at CSIRO in Australia points to a four-armed spiral structure with a pitch angle of 12 degrees for our galaxy. Authors combine and compare their results with data on carbon monoxide from the Northern Hemisphere. A report by Th. de Graauw, F. P. Israel, and C. P. de Vries on a survey by a Dutch group at La Silla in Chile also contains results from both hemispheres. The late entry by astronomers from the United States into radio research on the southern skies is a reflection of the economic recession in the United States, a lack of discernment by groups responsible for planning and funding research, and an overreliance on future observations by both radio and optical telescopes in space. A paper by R. S. Cohen, the head of the Columbia University Southern Hemisphere millimeter-wave survey group, describes the duplication at the U.S. observatory at Cerro Tololo in Chile of Columbia University's successful millimeter telescope. Surveys on the telescope have been successfully inaugurated, and the results bid fair to equal or surpass in quality the results obtained at the Manhattan station of Columbia.

The book neglects the optical and infrared spectral regions though it contains excellent contributions by J. A. Graham, who discusses a dust globule embedded in the Gum Nebula, and A. I. Sargent, who suggests that southern OB associations are keys to a fuller understanding of the processes of star formation.

The book contains a brief and clear review of prominent satellite missions and of high-energy surveys by K. Bennett and a clear overview of the scientific expectations of the European Space Astrometry Mission, Hipparcos, by M. A. C. Perryman.

Though the book is concerned chiefly with the Milky Way galaxy and specifically with its southern portion, well-justified attention is devoted to problems and results from other galaxies, specifically the Magellanic Clouds (which rise only in the South) and the Andromeda galaxy. A paper by J. S. Young discusses her survey of molecular clouds in spiral galaxies, which may open up our investigation of star formation and evolution beyond the limits of our own system. This of course would help us understand these processes better in our own Milky Way.

One worthy feature of the publication is the absence of discussion notes. Another is the presence of a fine set of appendixes; these show the distribution over the whole (northern and southern) Milky Way of neutral hydrogen, carbon monoxide, the 408-MHz continuum flux, and the gamma-ray emission. The final appendix shows the distribution of neutral hydrogen in the Andromeda galaxy for comparison with the Milky Way. These charts will be consulted long after many of the conclusions presented in the text have been revised and perhaps forgotten.

MARTIN MCCARTHY
Vatican Observatory Research Group, Tucson, Arizona 85726

Cosmology

The Constants of Physics. W. H. MCCREA and M. J. REES, Eds. Royal Society, London, 1983. viii pp. + pp. 211–363, illus. £23.40. First published in *Philosophical Transactions of the Royal Society of London*, series A, vol. 310. From a meeting, London, May 1983.

The artwork on the dust jacket of this volume of proceedings displays a number of what used to be called "fundamental constants," and Planck's constant $\hbar$ is only one of them. However, quantum mechanics (plus special relativity) dominates everything about a modern discussion of the constants of nature and is the reason why so many seemingly different topics have to be discussed together. The many facets of the subject are reflected in the number of contributions (18) in the volume, a large fraction of them written by theorists (but with frequent references to experiments). Sixty years ago one could discuss each constant separately, and, if the unit of length referred back to the size of the king's foot, one could have referred to a flea's foot or an elephant's foot instead. This soon changed when the importance of dimensionless ratios was demonstrated with the Sommerfeld fine structure constant, $\alpha = e^2\hbar c \approx 1/137$ (where e is the charge of the electron and c is the speed of light). It not only "tied together electrostatics and light," but it was a "dimensionless coupling constant"—the electrostatic force in the hydrogen atom was now "weak" in an absolute and unique sense. Atomic physics, it was thought, would now provide natural units for length, momentum, energy, frequency, and the like—the foot of the flea or the elephant was to be expressed in terms of the Bohr radius ($a_o \sim 0.5 \times 10^{-8}$ cm) of the hydrogen