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