studying Russia experiences in the most exaggerated form the basic problem of values in the social sciences and the humanities. If such an American does not want to be either a morally arrogant missionary or a morally flaccid anthropologist, the only alternative seems to be the disdainful recluse, and that has been choice of most. By a missionary I mean a scholar whose underlying purpose is to prove the superiority of our culture over theirs (or, in rare cases of inversion, of their culture over ours). By an anthropologist I mean a scholar who strives to avoid moral judgment, to establish the social function of such cultural variables as concentration camps or saturation bombing. By a disdainful recluse I mean a social scientist or humanist who turns his back on modern horrors altogether.

It is touching to discover that such a romantic stance has been struck by most American students of Russia, specifying old Russia, when Pushkin "raised himself a monument not made by hands," above the masonry of the state. Nabokov would approve; Solzhenitsyn would not. Byrnes unwittingly takes Nabokov's side, when he confesses the philosophic assumption that guides his path in Russian studies. "We should distinguish between the temporary political condition and the eternal human condition" (p. 82). My own assumption is that the two are inseparable, which makes it impossible to avoid either the missionary, who claims to know eternal values, or the anthropologist, who knows only temporary conditions. Endless tension between irreconcilable commitments cannot be avoided.

DAVID JORAVSKY
Department of History,
Northwestern University,
Evanston, Illinois

References and Notes

1. See *Commentary*, February, June, September, and November 1976, for Theodore Draper demanding an investigation and imputing bad faith or worse to the officials who rose to defend their labors.
2. And frequently amusing. Years ago, when I was starting my study of the Lysenko affair, an amiable young Machiavelli in the State Department encouraged me to apply for the cultural exchange, so that, when "they" vetoed me, "we" could veto a Soviet applicant who wanted to penetrate a militarily sensitive research program at the University of Illinois. The vetoes were duly exchanged, and I went to Russia on a tourist visa. Many years later "they" topped "our" joke, by giving me another tourist visa (my fifth), letting me get as far as Helsinki, and then phoning to say that the visa was revoked.
3. Philip Hanson, of the University of Birmingham, was quite persuasive on this point, against a passionate rebuttal by Michael Boretsky, of the Commerce Department, at a recent conference on Soviet science and technology, sponsored by the National Science Foundation and George Washington University. The proceedings of this conference are to be published by the George Washington University Program for Policy Studies in Science and Technology.

Advances with Lasers

Lasers in Physical Chemistry and Biophysics. Proceedings of a meeting, Thiais, France, June 1975. J. JOUSSOT-DUBIEN, Ed. Elsevier, New York, 1975. xvi, 522 pp., illus. $51.95.

In the past five years single-frequency and tunable lasers have played a crucial role in many of the advances made in understanding chemical and biological systems. In recognition of these advances the Societé de Chimie Physique devoted its 27th international meeting to "Lasers in Physical Chemistry and Biophysics." This collection of articles is the proceedings of that meeting. It was published rapidly, and the investigations reported do reflect current developments in the fields covered.

The 43 papers, which range in length from about 2 to about 15 pages, deal with a wide variety of topics. The subjects covered can broadly be classified into laser developments, dynamics of molecular processes, and molecular structure. Although these categories broadly delineate the uses chemists and biophysicists have made of lasers, there are a few laser applications that do not readily fit into them, and these are also dealt with in the volume. An example is provided by Michael Berns's elegant description of his recent studies of alterations in cell function produced by laser microirradiation.

In general the topics covered are appropriate to the goals implied in the title, and the reader is given a good appreciation of the areas in which significant progress is being made. For example, there is an excellent report on developments in vacuum ultraviolet lasers by D. J. Bradley, with a good set of references. Other articles present recent developments in dye lasers, and there are a couple of papers on organic and inorganic lasing materials.

One group of the "laser community" is particularly well represented in the book—those engaged in applying picosecond lasers to chemical and biological systems. The papers in this area cover a wide range of topics, including a report of a subpicosecond investigation and a good summary of the recent contributions made by picosecond spectroscopy to the understanding of the primary events of bacterial photosynthesis. There are also a few papers describing experiments with longer pulses in the nanosecond domain, including a good communication by Goldschmidt on the interpretation of laser flash photolysis in which many of the artifacts that are often obtained are pointed out.

Finally, there are reports relevant to laser isotope separation and several articles describing various applications of lasers in structural investigations. These investigations cover a variety of phenomena, biological and nonbiological. Particularly impressive is an account of the use of linear dichroism by photoselection to obtain the symmetry, orientation, and rotational mobility of cytochrome c oxidase in the inner membrane of mitochondria.

Many of the articles in the book have up-to-date references, some as late as 1976, but some of the bibliographies are quite inadequate. Questions posed by the participants and the authors' responses are included in most of the papers. The questions often bring out interesting and important aspects of the papers and in a few cases even indicate flaws in the arguments made in them.

Like most symposium volumes this one suffers from a heterogeneity in the material covered and in the quality of the papers included, and its usefulness is seriously limited by the lack of an index. It is, however, recommended as a rather complete account of the current applications of lasers to chemical and biological problems.

AARON LEWIS
School of Applied and Engineering Physics, Cornell University, Ithaca, New York

Extragalactic Astronomy

Galaxies and the Universe. ALLAN SANDAGE, MARY SANDAGE, and JEROME KRISTIAN, Eds. Index prepared by Gustav A. Tammann. University of Chicago Press, Chicago, 1976. xxii, 818 pp., illus. $45. Stars and Stellar Systems, vol. 9.

This long-awaited volume is the most important collection of review articles ever published in extragalactic astronomy, and it will serve as a standard reference for years to come. Yet it is a disappointing book in some ways, because parts of it are out of date. The quality is excellent. Each chapter was written by a recognized leader in its area, and many of the chapters are outstanding summaries as of the date of submission. (The dates of submission of individual chapters range from 1965 to 1974, with a median date of 1971.) Unfortunately, however, the book has taken so long to appear that the currency of most chapters has suffered, and some of them are now seriously behind present knowledge.

Galaxies and the Universe consists of 19 chapters, ranging in length from 16 to 100 pages. The first five chapters deal with galaxy properties that are studied chiefly by optical means, and the next four deal with radio emission from galaxies and quasars. Two chapters then discuss the formation and dynamics of galaxies. After a chapter on the distance scale, three chapters cover multiple galaxies and clusters, and two more deal with the general phenomenon of clustering. The final two chapters are devoted to the radio and optical observations that bear on cosmology.

As one might expect of such a varied collection, the individual chapters differ greatly in tone and in level. They range from flat empiricism to abstruse theory, and the point of view is often broadly ecumenical but occasionally so narrowly personal as to be of dubious general value. The overall coverage was good when the volume was planned, but a survey planned today would probably direct more attention to quasars (which get one brief chapter) and other high-energy phenomena, and it would include a chapter on the astrophysics of the big bang. In any case, the book would have been more valuable if it had included a chapter discussing cosmological models explicitly and systematically.

In spite of these shortcomings, *Galaxies and the Universe* is a valuable book. It belongs in every library that includes advanced astronomy.

More than half of the individual chapters fall in the range from quite good to uniquely valuable. I would single out several for particular mention. Allan Sandage updates his and Hubble's scheme of classification. Alan T. Moffet presents a comprehensive discussion of emission mechanisms in radio galaxies, followed by a good survey of observed properties. K. C. Freeman's chapter begins with a clear, concise summary of the stellar dynamics of the Milky Way and other galaxies and continues with the best existing survey of observations and theory concerning the structure of galaxies. Sidney van den Bergh discusses distance criteria and the distances of nearby galaxies. His discussion of methods is excellent, even though his 1969 evaluation of the Hubble constant does not give as much weight as one might give today to correlations between distance criteria and galaxy luminosity. Peter A. G. Scheuer not only summarizes the radio data that bear on cosmology, he adds some excellent insights and clarifications of his own.

In addition, there are valuable discussions of the content of galaxies (H. Spinrad and M. Peimbert), of methods of mass determination (E. M. and G. R. Burbidge), of energy curves and K-corrections (A. E. Whitford), of radio-source identifications (R. Minkowski and J. Kristian), of 21-centimeter studies (M. S. Roberts), and of optical observations and cosmology (A. Sandage).

The remaining eight chapters are not particularly to be recommended, either because they are intrinsically of lower quality or because the rush of extragalactic astronomy has left them behind. It is indeed a pity that George Field's excellently written chapter on galaxy formation is now out of date, and it is ironic that Maarten Schmidt's chapter on quasars is incomplete because it does not cover his own more recent work (although that work is in fact mentioned in Scheuer's chapter).

Publication of this volume completes the monumental series Stars and Stellar Systems, eight of whose nine projected volumes have appeared. The missing volume (volume 4, *Clusters and Binaries*) has not been produced, though the University of Chicago Press continues to list it. Even so, the astronomical community owes a great debt to the dozens of individuals who have labored to produce this series.

IVAN R. KING

Astronomy Department, University of California, Berkeley

Normal Motor Behavior

Motor Control. Issues and Trends. GEORGE E. STELMACH, Ed. Academic Press, New York, 1976. x, 232 pp. $17.50.

Since Sherrington's and Hughlings Jackson's studies beginning almost a century ago, the most widely known work on movement control by the brain has been carried out by physicians or medically trained physiologists. In the past few decades, however, increasingly important contributions in this field have come from "sports science," a discipline whose experimental subjects are for the most part healthy young adults, and whose goal is to understand normal motor behavior. There is a *Journal of Motor Behavior* devoted to studies arising from this group, and annual conferences devoted to sports science are now held in a number of countries throughout the world. Many members of this new scientific discipline had their original training in psychology, but the field also includes physiologists, biomedical engineers, clinicians, and cyberneticists.

With its increasingly interdisciplinary makeup, the field of sports science has become more and more concerned with bridging the gap between traditional descriptive studies of normal motor behavior and traditional physiological or clinical studies of brain organization. Stelmach's book brings together a series of papers that succeed in giving an excellent picture of the work being done in this new field.

A major topic dealt with by the contributors is the relation between afferent feedback arising during movement and the "central motor program" that sets the movement off. As Adams points out in his chapter on a "closed-loop theory of motor learning," Lashley brought the notion of the motor program to its current level of high esteem by his 1917 paper showing that a man with traumatic deafferentation could make reasonably accurate movements of his anesthetic lower limb. But what of normal subjects whose afferents are intact? It is to the role of afferent input in normal motor behavior that this book addresses itself. One contributor, Richard A. Schmidt, presents a strong array of evidence that "a motor program that produces movement without the involvement of peripheral feedback probably does not exist in human behavior." But Schmidt does not deny the value of the central motor program concept; instead, he provides an excellent definition of the central motor program as:

> . . . a set of prestructured alpha and gamma motor commands that, when activated, result in movement oriented toward a given goal, with these movements being unaffected by peripheral feedback indicating that the goal should be changed.

A major contribution of many of the chapters in this volume is their integration of literature from kinesiology, neurophysiology, and physiology. As Paul Weiss wrote many years ago,

> Nobody in his senses would think of questioning the importance of sensory control of movement. But just what is the precise scope of that control? Is the sensory influx a constructive agent, instrumental in building up the motor patterns, or is it a regulative agent, merely controlling the expression of autonomous patterns without contributing to their differentiation?

The experimental results presented in Stelmach's book go a long way to providing answers to Weiss's questions.

EDWARD V. EVARTS

Laboratory of Neurophysiology, National Institute of Mental Health, Bethesda, Maryland