

whose word actually was Pragmaticism; putting the spanning of the American continent by railroad one year ahead of the true date; being rather unlucky with the transcription of French phrases and names; and generally failing to distinguish, under the general rubric of Darwinism, the idea of evolution from the hypothesis of natural selection. But these, it must be said again, are the merest specks on the surface of a first-class work.

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Atmospheric Phenomena

Aurora and Airglow. Proceedings of a NATO Advanced Study Institute, Stafsfordshire, England, August 1966. BILLY M. McCORMAC, Ed. Reinhold, New York, 1967. 697 pp., illus. \$28.50.

The aurora, together with the more widespread but fainter upper-atmosphere emission, the airglow, is an exciting subject for study in the space age. The sun causes the aurora to be produced on earth. The magnetosphere of the earth is perturbed in some way by the particles or waves of the solar wind. The upper atmosphere is then bombarded by streams of charged particles. The atoms and molecules of the upper atmosphere are spectroscopically excited, increased ionization is produced, and the entire gas is heated. This description of the aurora suggests the broad range of physical interests that are involved in the study of this solar-geophysical phenomenon and the great distances over which it may be necessary to conduct observations.

Many of the contributions in this proceedings volume are tutorial in style and serve very well as reviews of various aspects of the subject. Sydney Chapman gives a masterly history of efforts to account for aurora and airglow, in which one may discover, for example, what were Benjamin Franklin's ideas on the aurora. Twilight and dayglow observations and theory are covered very nicely by Gadsden and by Noxon. The worldwide morphology of the nightglow is presented by Roach and Smith. There is an excellent account by O'Brien of satellite observations of the relation of particle fluxes and auroras. The theoretical interpretation of how the solar wind perturbs the magnetosphere and how the auroral particles are accelerated in the geo-

magnetic tail is given by Axford and by Speiser. Omholt has an excellent review of the spectroscopic excitation mechanisms in the aurora. There are many other very fine reviews on auroral and airglow theory and observations, including ideas on how electric fields may be involved in auroral excitation and accounts of how observations have been conducted from the polar cap to the equator.

This volume also contains many contributions of what must be classified as unrefereed research reports. The quality and permanent value of these papers vary. Some are reports of recent rocket observations that were carried out with definite objectives and that succeeded very nicely in producing results that more carefully define the primary electron influx producing the aurora. There are other reports, however, of rocket experiments that attempted to measure all parameters that were measurable without any apparent scientific objectives in mind.

A remarkable achievement of this volume is that such a handsome printing and editing job has appeared within a year after the institute was held. The book contains an excellent introduction to the subject matter by the editor, an interesting conference summary conducted by a panel, and finally the editor's conclusions about the current state of knowledge in the field.

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Aspects of Primate Interaction

Social Communication among Primates. Based on an international symposium held in Montreal, December 1964. STUART A. ALTMANN, Ed. University of Chicago Press, Chicago, 1967. 406 pp., illus. \$15.

This interesting and important volume contains 17 chapters based on papers presented at a symposium at the 1964 meeting of the AAAS. The contributors represent a variety of disciplines: anthropology, psychology, psychiatry and neurology, linguistics, zoology. This breadth is due not only to the fact that the study of behavior naturally brings together scientists of many different backgrounds, but also to the excellent planning by the editor, who was also the organizer of the symposium. The techniques needed to re-

veal the roots of behavior belong to no one traditional science, and it is to be hoped that future studies of primate behavior evolve on an even broader base than that reflected in this volume.

The volume is dedicated to the memory of the late K. R. L. Hall, who died the summer after the symposium. Hall was a leader in elucidating the relations between controlled laboratory experiments and field observations. The importance of this point of view is evident in many of the papers in the volume and the discussions that follow them. The emphasis on the complementarity of the two kinds of study reflects a trend that holds great promise for the future of both.

The volume is divided into five parts. The first is on reproductive behavior and includes papers on breeding in *Lemur catta* (Jolly), reproductive cycles in baboons (Rowell), and mother-infant relations in macaques (Rosenblum and Kaufman; Jensen, Bobbitt, and Gordon), with discussion by Altmann. The second part contains three papers on agonistic behavior—in baboons (Kummer) and in rhesus (Kaufmann; Sade)—with discussion by Rioch. There are three papers in the third section, on causal mechanisms—experimental approaches (Miller), neurological aspects of vocalizations (Robinson), brain stimulation of squirrel monkeys (Ploog), with discussion by Rioch. The fourth part, on social dynamics, includes a paper on the remarkable aye-aye (Petter and Petter), one on newly acquired behavior patterns (Tsumori), and two on langurs (Sugiyama; Ripley), with discussion by Warren. The final section is on communication processes—social interaction in patas (Hall), auditory communication in vervets (Struhsaker), structure of primate communication (Altmann), with discussion by Sebeok and final editor's comments by Altmann.

The papers are too diverse to permit the book to be easily summarized or evaluated, but some major points can be made. Because, as several of the papers indicate, it is now possible to monitor internal states by brain stimulation and telemetry and to gather objective information on events in "the little black box," a new era in behavior studies has begun. These technical advances render obsolete theories of behavior which attempted to limit the study of behavior to externally observable events and considered internal events as unascertainable in principle. Further, these studies show that the notions of the brain as a *tabula rasa*