ment for the ten-hour day that grew up in the 1840's, a time earlier than his thesis allows for a movement in behalf of increased leisure.

Generally, though, Rodgers is forthright in discussing the limitations of his thesis, and the surprising thing is that, despite the range of his examples and subjects, he trips so rarely. The overall result is one of the most refreshing and penetrating analyses of the relation of diverse levels of 19th-century American culture that it has been my pleasure to read in a long time.

CARL N. DEGLER
Department of History, Stanford University, Stanford, California 94035

Small Bodies

Comets, Asteroids, Meteorites. Interrelations, Evolution and Origins. Papers from a colloquium, Lyon, France, Aug. 1976. A. H. DELSEMME, Ed. University of Toledo, Toledo, Ohio, 1977 (available from the University of Toledo Bookstore). xxii, 588 pp., illus. $36.50.

This book is a feast. With 75 papers by a total of 107 authors (there is some redundancy, but not much), even the most jaded palate should find something of interest. The metaphor is not altogether inappropriate, for this is a report of a colloquium held in Lyon, a traditional center of great French cuisine.

The papers are organized into nine sections: Physical Nature of Comets, The Orbital Evolution of Comets, Meteors and Meteoroids, Physical Nature of Asteroids, Orbital Evolution and Fragmentation of Asteroids, Primitive Meteorites, Differentiated Meteorites, The Origin of Comets, The Primitive Solar Nebula. The mousseline au chocolat is provided by the editor—a smooth, tactful summary that allows all the participants (and the reader) to feel comfortable about the preceding heroics. Along the way, extra seasonings are provided in the form of transcribed discussions following most of the chapters—an excellent addition to any volume of proceedings and especially interesting for such a wide-ranging and controversy-inviting conference as this one.

There is a remarkable variety in the presentations. We find sober catalogs of basic data, such as Morrison's listing of asteroid diameters and albedos, Holweger's comparison of meteoritic and solar abundances, Zellner and Bowell's discussion of asteroid compositional types, and Scott's classification of iron meteorites, and reports on oxygen isotope ratios in meteorites by Clayton, carbon isotopes in comets by Vanysek, and the discovery of the long-sought evidence for ^{26}Al by Papanastassiou *et al.* There are laboratory experiments attempting to reproduce conditions in comets (Dobrovolsky and Kajmakov) and computer experiments to analyze comet chemistry (Huebner, Delsemme and Rud) and to explore orbital histories of asteroids (Scholl and Froeschle, Carusi and Massaro, and others) and of comets (Marsden, Everhart, and others). There are careful discussions of basic physics underlying the Poynting-Robertson effect (Soter *et al.*) and the reflectance spectra of asteroids (Gaffey and McCord), and there are free-wheeling speculations that satellites may be formed from comets (Singer), that comets may come from volcanoes on Jupiter (Vsekhsvyatsky), and that the asteroids and comets may be the remains of a planet of 90 earth masses that blew up 600 million years ago (van Flandern). It is a tribute to the scientists present that each of these suggestions is received with tact and care—there is no attempt to sweep nontraditional ideas under the rug.

A wide variety of observational papers is also included. Reviews of compositional studies of comets are given by Delsemme and Donn, who conclude, in agreement with Kresak, that there is no fundamental difference between "new" comets (comets approaching the inner solar system for the first time) and "old" or short-period comets. Millman presents a stimulating review of observations of meteoroids, indicating their apparent similarity in composition to the type C-1 and C-2 carbonaceous chondrites. Brownlee *et al.* describe studies of particles collected in the upper atmosphere that are presumably remnants of these meteoroids and discuss possible origins of particles from carbonaceous chondrites or comets. Just as the unwary reader might be inclined to conclude that meteorites come from comets, the many papers on asteroids and on the meteorites themselves provide convincing evidence for an asteroidal origin. Support for this view is nicely summarized by Levin.

What are the sources of the meteorites in our museums? Many of the authors struggle with this question; no unanimously supported picture emerges. We don't really know how comets evolve or whether "dead" comets represent a possible source of stony material. Asteroids are not entirely satisfactory either, since the ordinary chondrites do not seem to be represented among the types of asteroid spectra recorded by ground-based observers. It appears that missions to comets and asteroids—especially missions that return samples—may be required to resolve these issues.

In his introduction, Delsemme suggests that this volume is devoted to a study of footprints—the record that remains of the early history of the solar system as determined by conditions in the primitive solar nebula. It is clear from these papers that this nebula must have been far more heterogeneous in structure and composition than most students of the subject have thought. Did it already contain comet nuclei? Are some interstellar grains therefore trapped in comets? And what events caused the isotope anomalies found in the meteorites and generated the short-lived radioactivities that played such a crucial role in the formation of planets and satellites? Where *do* the meteorites come from? These proceedings demonstrate that there is a vigorous and intelligent community of scientists hard at work trying to answer these questions and generating new ones as the inquiry proceeds. One can scarcely fail to share their interest and enthusiasm as one reads the papers and discussions in this stimulating book.

TOBIAS OWEN
Department of Earth and Space Sciences, State University of New York, Stony Brook 11794

Audition and Behavior

Recognition of Complex Acoustic Signals. Papers from a workshop, Berlin, Sept. 1976. THEODORE H. BULLOCK, Ed. Dahlem Konferenzen, Berlin, 1977 (U.S. distributor, Heyden, Bellmawr, N.J.). 404 pp., illus. Paper, $25. Life Sciences Research Reports, 5.

The general strategy of science is to turn magic into ordered explanations. The focus of ethology is on that ultimate bit of magic, behavior. Pioneering ethologists imposed on behavior a controversial conceptual order that invoked several smaller bits of magic—releasers, fixed-action patterns, imprinting, and so on. It was left to physiologists to show that these orderly concepts reflected real, underlying processes. Neither group, however, found the work of the other particularly useful. When physiologists uncovered unitary feature detectors in the visual system for lines, spots, moving edges, binocular disparity, and so on, traditional ethologists, looking for the holistic patterns required by their treasured Gestalt psychology, saw no connection with releasers. More recent work demonstrating that many detectors

have classical ethological critical periods has provided convincing evidence that unitary detectors are probably the basic elements of releasers. As a result, the entrenched Gestalt notion of releasers is finally being relinquished.

While physiologists have been steadily imposing order on the visual system, the auditory system has successfully retained its traditional entropy. Debate still rages even over how animals hear and distinguish sounds of different frequencies. In the past three years, however, great progress has been made toward relating the auditory system and behavior. The book under review reflects that progress and the enthusiasm it has engendered. By juxtaposing the latest work on innate recognition of human speech sounds, for example, with experiments on the mechanisms by which birds and bats extract their species-specific information from the surrounding cacophony, it mirrors the growing realization that general, unitary auditory feature detectors exist and almost certainly underlie auditory releasers. These conceptual structures, fashioned from the generalizations of classical ethology and the visual system, have proved enormously useful in directing recent auditory research. The excellent contributions of Peter Marler and Mark Konishi to the volume, for instance, foreshadow the substantial advances each has subsequently published. Marler and Peters recently identified the unitary auditory feature that triggers song learning in swamp sparrows (*Science* **198**, 519 [1977]), and Knudsen, Konishi, and Pettigrew have just discovered a map of the auditory world in the owl brain that parallels the visual system projection right down to the overrepresented fovea (*Science* **198**, 1278 [1977]). The several papers Bullock includes on human speech recognition substantially extend the pioneering work of Peter Eimas and his collaborators (*Science* **171**, 303 [1971]) on that increasingly fascinating subject. The group report organized by J. A. Simmons on bat echolocation surely represents, too, the best available review of evolution's most impressive attempt to push auditory feature detectors and information processing to theoretical limits. The surprising success of this volume of what is basically conference proceedings arises from the increasingly centripetal interaction of physiologists and ethologists—of data, observation, and theory—in investigating the auditory system.

JAMES L. GOULD
Department of Biology, Princeton University, Princeton, New Jersey 08540

Books Received

Air Pollution. Arthur C. Stern, Ed. Academic Press, New York, ed. 3, 1977. Vol. 2, The Effects of Air Pollution. xxii, 686 pp., illus. $43.50. Vol. 5, Air Quality Management. xx, 702 pp., illus. $39.50. Environmental Sciences.

Alternatives to Piaget. Critical Essays on the Theory. Linda S. Siegel and Charles J. Brainerd, Eds. Academic Press, New York, 1977. xiv, 262 pp., illus. $16.50.

Basic Statistics. A Primer for the Biomedical Sciences. Olive Jean Dunn. Wiley, New York, ed. 2, 1977. xiv, 218 pp., illus. $12.95. Wiley Series in Probability and Mathematical Statistics.

Biology of Bats. Vol. 3. William A. Wimsatt, Ed. Academic Press, New York, 1977. xvi, 652 pp., illus. $59.

The California Quail. A. Starker Leopold. University of California Press, Berkeley, 1978. xxii, 282 pp., illus. $14.95.

Catalogue of Fossil Hominids. Part 1, Africa (Second Edition). Kenneth Page Oakley, Bernard Grant Campbell, and Theya Ivitsky Molleson, Eds. British Museum (Natural History), London, 1977. xvi, 224 pp., illus. Paper, £12.

Complementarity in Mathematics. A First Introduction to the Foundations of Mathematics and Its History. Willem Kuyk. Reidel, Boston, 1977. 186 pp. $15.95. Mathematics and Its Applications, vol. 1.

Concepts in Mammalian Embryogenesis. Michael I. Sherman, Ed. MIT Press, Cambridge, Mass., 1977. xvi, 404 pp., illus. $24.95. Cell Monograph Series, 1.

Dear Russell—Dear Jourdain. A Commentary on Russell's Logic, Based on His Correspondence with Philip Jourdain. I. Grattan-Guinness. Columbia University Press, New York, 1977. vi, 234 pp., illus. $20.

Ethology. The Biological Study of Animal Behavior. Rémy Chauvin. Translated from the French edition (Paris, 1975) by Joyce Diamanti. International Universities Press, New York, 1977. xii, 246 pp., illus. $12.50.

Every Child's Birthright. In Defense of Mothering. Selma Fraiberg. Basic, New York, 1977. xiv, 162 pp. $8.95.

Excited States in Organic Chemistry and Biochemistry. Proceedings of a symposium, Jerusalem, Mar. 1977. Bernard Pullman and Natan Goldblum, Eds. Reidel, Boston, 1977. xiv, 448 pp., illus. $39.50. Jerusalem Symposia on Quantum Chemistry and Biochemistry, vol. 10.

Fundamentals of Mycology. J. H. Burnett. Arnold, London, and Crane, Russak, New York, ed. 2, 1977. xiv, 674 pp., illus. $57.50.

Future Developments in Telecommunications. James Martin. Prentice-Hall, Englewood Cliffs, N.J., ed. 2, 1977. xviii, 668 pp., illus. $44.50. Prentice-Hall Series in Automatic Computation.

Genetic Engineering for Nitrogen Fixation. Proceedings of a conference, Upton, N.Y., Mar. 1977. Alexander Hollaender and seven others, Eds. Plenum, New York, 1977. xiv, 538 pp., illus. $37.50. Basic Life Sciences, vol. 9.

Hybrid Microcircuits. T. D. Towers. Pentech Press, London, and Crane, Russak, New York, 1977. viii, 246 pp., illus. $15.75.

Index of Nutrition Education Materials. Nutrition Foundation, Washington, D.C., ed. 2, 1977. vi, 238 pp. Paper, $8.75.

Magnetic Circuits and Transformers. A First Course for Power and Communication Engineers. By Members of the Staff of the Department of Electrical Engineering, Massachusetts Institute of Technology. MIT Press, Cambridge, Mass., 1977. xxiv, 718 pp., illus. Paper, $6.95. Principles of Electrical Engineering Series, vol. 2. Reprint of the 1943 edition.

Meaning and Discourse. A Computer Model of Psychoanalytic Speech and Cognition. John Henry Clippinger, Jr. Johns Hopkins University Press, Baltimore, 1978. xviii, 232 pp. $15.

Mechanical Seals. E. Mayer. Translated from the German edition (Düsseldorf, 1974). Newnes-Butterworths, Boston, 1977. xii, 292 pp., illus. $19.95.

Preparation and Crystal Growth of Materials with Layered Structures. R M. A. Lieth, Ed. Reidel, Boston, 1977. x, 280 pp., illus. $38. Physics and Chemistry of Materials with Layered Structures, vol. 1.

Principles of Industrial Metalworking Processes. Geoffrey W. Rowe. Arnold, London, 1977 (U.S. distributor, Crane, Russak, New York). xxii, 408 pp., illus. $37.50. New edition of *An Introduction to the Principles of Metalworking*.

Proceedings of the Fourth Tihany Symposium on Radiation Chemistry. Keszthely, Hungary, June 1976. Péter Hedvig and Róbert Schiller, Eds. Akadémiai Kiadó, Budapest, 1977. 1086 pp., illus. $65.

Progress in Immunology III. Proceedings of a congress, Sydney, Australia, July 1977. T. E. Mandel, Christina Cheers, C. S. Hosking, I. F. C. McKenzie, and G. J. V. Nossal, Eds. North-Holland, Amsterdam, 1977 (U.S. distributor, Elsevier, New York). xiv, 856 pp., illus. $88.75.

Subnuclear Resonance: Science Unification Key. Old Data—New Concepts. Harold H. Belcher. Exposition Press, Hicksville, N.Y., 1977. x, 244 pp., illus. $14.50.

Surface Carbohydrates of the Prokaryotic Cell. I. Sutherland, Ed. Academic Press, New York, 1977. x, 472 pp., illus. $38.

Symposium on Microbial Production and Utilization of Gases (H_2, CH_4, CO). Göttingen, Germany, Sept. 1975. Hans G. Schlegel, Gerhard Gottschalk, and Norbert Pfennig, Eds. Published for Akademie der Wissenschaften zu Göttingen by Verlag Erich Goltze, Göttingen, 1976. 424 pp., illus. Paper, DM 60.

Systems. Approaches, Theories, Applications. Proceedings of a symposium, Plattsburgh, N.Y., Apr. 1975. William E. Hartnett, Ed. Reidel, Boston, 1977. xiv, 202 pp. $32.

The Technological Level of Soviet Industry. Ronald Amann, Julian Cooper, and R. W. Davies, Eds. Yale University Press, New Haven, 1977. xxxii, 576 pp., illus. $30.

Theoretische und experimentelle Untersuchung der physiko-chemischen Reaktionprozesse unter Berücksichtigung der Vibrationsrelaxation in Gemischen aus CO_2-O_2-N_2 im Stosswellenrohr. Arnold Frohn and Günter Berg. Westdeutscher Verlag, Wiesbaden, 1977. vi, 128 pp., illus. Paper, DM 26. Forschungsbericht des Landes Nordrhein-Westfalen, No. 2683.

The Wave and Ballistic Theories of Light. A Critical Review. R. A. Waldron. Frederick Muller, London, 1977 (U.S. distributor, Humanities Press, Atlantic Highlands, N.J.). xiv, 202 pp., illus. $25.

Women in Medicine. A Bibliography of the Literature on Women Physicians. Sandra L. Chaff, Ruth Haimbach, Carol Fenichel, and Nina B. Woodside, Eds. Scarecrow Press, Metuchen, N.J., 1977. xii, 1124 pp. $35.