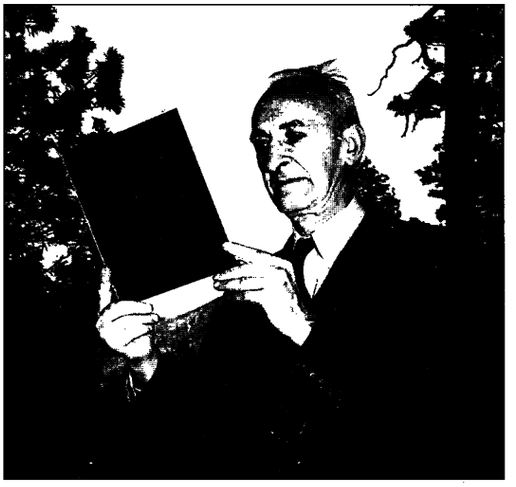
Lowell's Venture

The Explorers of Mars Hill. A Centennial History of Lowell Observatory, 1894–1994. WILLIAM LOWELL PUTNAM and others. Published for Lowell Observatory by Phoenix Publishing, Canaan, NH, 1994. xxii, 289 pp., illus. $30.



Left, Percival Lowell. *Right*, "E. C. Slipher examines negatives by the north light of the [Lowell] observatory reading room in 1953." [From *The Explorers of Mars Hill*; Lowell Observatory photograph]

The Arizona observatory founded by Percival Lowell celebrates its centennial in 1994. Orientalist and successful entrepreneur, Lowell turned to astronomy in the 1890s. He was convinced of the existence of civilized life on Mars. A stream of books and popular essays flowed from his pen, and in time the reading public came to identify Lowell and his observatory with life on Mars. Long after Lowell's observations of canals on the red planet were discredited, many amateur astronomers in Europe and the United States remained true believers.

Lowell is one of the most enigmatic figures in the history of American science. He was a generalist in an age of growing specialization. Perhaps influenced by romantic *Naturphilosophie* imbibed from his Harvard mentor, the mathematician Benjamin Peirce, Lowell saw nature as a whole. At a time when astrophysics was moving toward ascendancy in American astronomy, he dedicated his observatory to the study of objects in the solar system. Brilliant and arrogant, Lowell ruled the institution on Mars Hill with an iron hand. Staff research projects were subordinated to the proprietor's interest in solar system astronomy. In part, Lowell maintained his power by selecting staff members who were, in comparison to astronomers at institutions like the Lick, Yerkes, or Mount Wilson observatories, marginal. Lowell's scientific staff, made up mostly of graduates from Indiana University, had not been trained in a first-rate astronomy program such as those at Chicago or Berkeley.

"The 40-inch dome [at the Lowell Observatory] shows its strength after heavy snow in 1916." [From *The Explorers of Mars Hill*; Lowell Observatory photograph]

Perhaps the most exciting work done at the Lowell Observatory in its early years was the measurement by V. M. Slipher (1912) of the radial velocities of nebulae. This opened the way for others to develop the model of the expanding universe. Aside from the early observational work of Slipher, however, Lowell astronomers took no further part in these exciting developments. The Slipher story is recounted by historian Robert Smith in chapter 4 of this centennial history, compiled by the Lowell Observatory trustee, William Lowell Putnam.

Between the wars, the observatory was financially decimated by a bitter struggle with Lowell's grasping widow, Constance, who attempted to break her husband's will. The discovery of Pluto, whose existence was the subject of protracted mathematical investigations by Lowell, is the observatory's single claim to fame in the inter-war years. Only after 1950, as a consequence of generous federal patronage, did the Lowell Observatory move into the mainstream of American science.

With the exception of the chapter by Smith, this volume does not represent the work of professional historians of science. Only a few of the scientist contributors seem aware of the rich archival collections at the Lowell Observatory. None attempt to place the history of the institution in the larger context of 19th- and 20th-century science or society. However, historians of science will find in this book a number of topics worthy of careful consideration. Readers will be grateful to Putnam for assembling a fascinating collection of photographs. Few scientific research institutions have iconography collections that can rival the treasures stored in the vault on Mars Hill.

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Other Books of Interest

The History of Modern Mathematics. Vol. 3, Images, Ideas, and Communities. EBERHARD KNOBLOCH and DAVID E. ROWE. Academic Press, San Diego, CA, 1994. xvi, 301 pp., illus. $55.

Five years ago there appeared a two-volume work entitled *The History of Modern Mathematics*, edited by David E. Rowe and John McCleary (see *Science* **248**, 1561 [1990]). A "groundswell of activity" on the themes of the earlier volumes has led to the publication of this complementary collection of nine papers. Like its predecessors, the new volume represents a variety of approaches, technical, philosophical, and social. The papers (though the intended connection is somewhat obscured by an apparent production error) form three groups. The first consists of

discussions of the historiographic approaches taken by the 19th-century historians of mathematics Moritz Cantor and H. G. Zeuthen (J. Lützen and W. Purkert), of the 1770–1940 "prehistory" of linear programming (I. Grattan-Guinness), and of David Hilbert's activities in support of his "axiomatic programme" (V. Peckhaus). In three following papers, devoted more specifically to mathematical ideas, are examined Rudolf Lipschitz's 1869–73 work on differential geometry and mechanics (R. Tazzioli), Karl Weierstrass's 1841 proof of the Laurent expansion for functions on an annulus (P. Ullrich), and the discovery by Weierstrass and rediscovery by Bernhard Riemann of the "removable singularity theorem" (Ullrich). The contributors then turn to the social aspects of the history of mathematics, with accounts of the development of a "strong, active, deeply-rooted community" of American mathematicians at the turn of the last century and of the participation of women in that community (D. D. Fenster and K. H. Parshall) and an overview of interactions between mathematicians of the United States and China in the period 1850–1890 (D. Zhang and J. Dauben). Each paper is preceded by an abstract, and the tables of contents of the two earlier volumes are included, but there are no indexes.

—Katherine Livingston

Early Quantum Electrodynamics. A Source Book. ARTHUR I. MILLER. Translations from the German by Walter Grant. Cambridge University Press, New York, 1994. xx, 265 pp. $59.95 or £40.

This book is devoted to "the genesis of a theory that has been on the cutting edge of physics ever since P. A. M. Dirac's quantization of the radiation field in 1927" but whose history has had less attention than developments that preceded it. To make the subject accessible to those with limited resources to explore it, Miller here presents a "frame-setting essay" and reprintings of 11 classic papers emphasizing "conceptual transformations . . . which carried physicists to the threshold of renormalization theory." Miller's essay (116 pages including notes and references) traces the subject in some mathematical detail from Bohr's atomic theory as enunciated in 1913 through the researches of Sin-Itoro Tomonaga, Julian Schwinger, Richard Feynman, and Freeman Dyson up to about 1950. The "selected papers," all but one of them appearing in new English translations, begin with Werner Heisenberg's "The self-energy of the electron" (1930) and "Remarks on radiation theory" (1931) and two 1934 papers by Dirac and end with H. A. Kramers's "The interaction between charged particles and the radiation field" of 1937–38. Authors of the intervening papers are (alone or in combination) Viktor Weisskopf, Heisenberg twice again, Wolfgang Pauli, and Marcus Fierz. An index to Miller's essay concludes the volume.

—Katherine Livingston

Updating and Correction

The current editions of two books edited by William T. Golden, *Science Advice to the President* and *Science and Technology Advice to the President, Congress, and Judiciary*, published this year by AAAS Press, are now being distributed by Transaction Publishers, New Brunswick, NJ 08903, at the prices $22.95 and $27.95 (paper), respectively, and are no longer available from AAAS. A related work, Golden's 1991 compilation *Worldwide Science and Technology Advice to the Highest Levels of Government*, originally published by Pergamon Press, is also being distributed by Transaction Publishers, at $25.95. For more information about the books see *Science* 1 July, p. 127.

In the review of K. S. Thorne's *Black Holes and Time Warps* (13 May, p. 999–1000), the captions and illustrations on p. 1000 were mismatched. The correct order of the captions is (i) "A heavy rock . . ."; (ii) "Cosmic radio waves . . ."; and (iii) "The trajectories in space . . . ."

Books Received

Apoptosis. Enrico Mihich and Robert T. Schimke, Eds. Plenum, New York, 1994. x, 272 pp., illus. $89.50. Pezcoller Foundation Symposia, vol. 5. From a symposium, Trento, Italy, June 1993.

Applied Ecology. Edward I. Newman. Blackwell Scientific, Cambridge, MA, 1993. viii, 328 pp., illus. Paper, $32.95.

Biodeterioration Research 4. Mycotoxins, Wood Decay, Plant Stress, Biocorrosion, and General Biodeterioration. Gerald C. Llewellyn, William V. Dashek, and Charles E. O'Rear, Eds. Plenum, New York, 1994. xviii, 686 pp., illus. $149.50. From a meeting, Aug. 1991.

Causal Mechanisms of Behavioural Development. Jerry A. Hogan and Johan J. Bolhuis, Eds. Cambridge University Press, New York, 1994. xx, 416 pp., illus. $54.95.

Cellular Adhesion. Molecular Definition to Therapeutic Potential. Brian W. Metcalf et al., Eds. Plenum, New York, 1994. xxii, 318 pp., illus. $79.50. New Horizons in Therapeutics.

The Chemokines. Biology of the Inflammatory Peptide Supergene Family 2. I. J. D. Lindley, J. Westwick, and S. Kunkel, Eds. Plenum, New York, 1994. xvi, 227 pp., illus. $75. Advances in Experimental Medicine and Biology, vol. 351. From a symposium, Baden bei Wien, Austria, Aug. 1992.

Durkheim's Philosophy of Science and the Sociology of Knowledge. Creating an Intellectual Niche. Warren Schmaus. University of Chicago Press, Chicago, 1994. x, 314 pp. $50; paper, $24.95. Science and Its Conceptual Foundations.

Elephant Seals. Population Ecology, Behavior, and Physiology. Burney J. Le Boeuf and Richard M. Laws, Eds. University of California Press, Berkeley, 1994. xviii, 414 pp., illus. $58. From a conference, Santa Cruz, CA, May 1991.

Explaining Scientific Consensus. The Case of Mendelian Genetics. Kyung-Man Kim. Guilford, New York, 1994. xxiv, 239 pp. $37.95. Conduct of Science Series.

From Genotype to Phenotype. Steve E. Humphries and Sue Malcolm. Bios Scientific, Oxford, U.K., 1994 (U.S. distributor, Books International, Herndon, VA). xx, 290 pp., illus. $99 or £55. Human Molecular Genetics.

Genetics and Medicine in the United States, 1800 to 1922. Alan R. Rushton. Johns Hopkins University Press, Baltimore, MD, 1994. xiv, 209 pp. $45.

Greatness. Who Makes History and Why. Dean Keith Simonton. Guilford, New York, 1994. x, 502 pp. $29.95; paper, $19.95.

The History of Modern Mathematics. Vol. 3, Images, Ideas, and Communities. Eberhard Knobloch and David E. Rowe. Academic Press, San Diego, CA, 1994. xvi, 301 pp., illus. $55.

The Impact of Long-Term Monitoring on Variable Star Research. Astrophysics, Instrumentation, Data Handling, Archiving. Christiaan Sterken and Mart de Groot, Eds. Kluwer, Norwell, MA, 1994. xvi, 457 pp., illus. $185 or £22 or Dfl. 310. NATO Advanced Science Institutes Series C, vol. 436. From a workshop, Ghent, Belgium, Nov. 1993.

Life History and Biogeography. Patterns in *Conus*. Alan J. Kohn and Frank E. Perron. Clarendon (Oxford University Press), New York, 1994. viii, 106 pp., illus., + plates. $56. Oxford Biogeography Series, no. 9.

Linus Pauling. Scientist and Advocate. David E. Newton. Facts on File, New York, 1994. viii, 136 pp., illus. $16.95. Makers of Modern Science Series.

Methods of Investigation of the Dead Sea Scrolls and the Khirbet Qumran Site. Present Realities and Future Prospects. Michael O. Wise *et al.*, Eds. New York Academy of Sciences, New York, 1994. xiv, 514 pp., illus. Paper, $125. Annals of the New York Academy of Sciences, vol. 722. From a conference, New York, Dec. 1992.

Nuclear Pursuits. The Scientific Biography of Wilfrid Bennett Lewis. Ruth Fawcett. McGill-Queen's University Press, Montreal, 1994. xxii, 210 pp., illus. $34.95.

100 Years of Pithecanthropus. The *Homo erectus* Problem. Jens Lorenz Franzen, Ed. Senckenbergische Naturforschende Gesellschaft, Frankfurt am Main, Germany, 1994. 361 pp., illus. Paper, DM 80. *Courier Forschungs-Institut Senckenberg*, 171. From a conference, Frankfurt am Main, Germany, Dec. 1991.

Przewalski's Horse. The History and Biology of an Endangered Species. Lee Boyd and Katherine A. Houpt, Eds. State University of New York Press, Albany, 1994. xviii, 313 pp., illus. $19.95. SUNY Series in Endangered Species.

Quantitative Genetic Studies of Behavioral Evolution. Christine R. B. Boake, Ed. University of Chicago Press, Chicago, 1994. x, 390 pp., illus. $66; paper, $24.95. Based on a symposium, Binghamton, NY, 1990.

Robot Evolution. The Development of Anthrobotics. Mark E. Rosheim. Wiley, New York, 1994. xviii, 423 pp., illus. $39.95.

The Role of the Chimpanzee in Research. G. Eder, E. Kaiser, and F. A. King, Eds. Karger, Farmington, CT, 1994. xx, 203 pp., illus. $182.50 or DM 273 or SwF 228. From a symposium, Vienna, May 1992.

Scarcity or Abundance? A Debate on the Environment. Norman Myers and Julian L. Simon. Norton, New York, 1994. xx, 254 pp., illus. $21.

Trends in Cancer Incidence and Mortality. R. Doll, J. F. Fraumeni, Jr., and C. S. Muir, Eds. Cold Spring Harbor Laboratory Press, Cold Spring Harbor, NY, 1994. viii, 583 pp., illus. $144. Cancer Surveys, vol 19/20.

Vegetation in Eastern North America. Vegetation System and Dynamics under Human Activity in the Eastern North American Cultural Region in Comparison with Japan. Akira Miyawaki, Kunio Iwatsuki, and Miroslav M. Grandtner, Eds. University of Tokyo Press, Tokyo, 1994 (distributor, Columbia University Press, New York). x, 515 pp., illus. $250.

The World on Paper. The Conceptual and Cognitive Implications of Writing and Reading. David R. Olson. Cambridge University Press, New York, 1994. xx, 318 pp., illus. $24.95.

Young Children's Understanding of Pretense. Paul L. Harris and Robert D. Kavanaugh with Henry M. Wellmand and Anne K. Hickling. University of Chicago Press, Chicago, 1993. vi, 110 pp., illus. Paper, $9.75. Monographs of the Society for Research in Child Development, serial no. 231, vol. 58, no. 1, 1993.

Zero to Lazy Eight. The Romance of Numbers. Alexander Humez, Nicholas Humez, and Joseph Maguire. Simon and Schuster, New York, 1994. 228 pp., illus. Paper, $11. Touchstone Book. Reprint, 1993 ed.