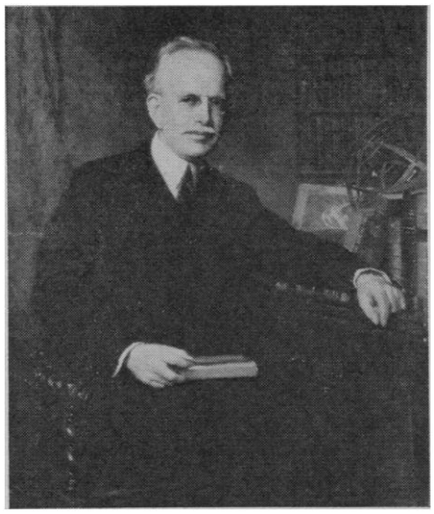

George Ellery Hale (1868–1938). [Photograph by George F. Clifton from a painting by S. Seymour Thomas]

Chicago in the 1880's and his father's successful elevator-manufacturing business made it possible for young George to have an expensive telescope, to visit Connecticut each year, to travel widely, and to attend M.I.T. The breadth and experience gained from this upper-middle-class life probably gave him the confidence to "barge in" on established authorities and to ask for contributions in money and effort that were unusual in scientific circles at the time. His early successes led to larger and larger ventures, culminating in the 200-inch telescope. Many of the advances in astronomical thought concurrent with Hale's telescope-building are summarized in Struve and Zeberg's *Astronomy of the 20th Century* (Macmillan, 1962). The instruments and observatories themselves are described in a book I have just completed, *Telescopes* (Macmillan, 1966).

Hale started at the age of 12 by recruiting his younger brother and sister as lab assistants and observers. He soon got gratings from Rowland and optical parts from Brashear, and, later, in 1895, help from physicists in establishing *The Astrophysical Journal*. He continued with organizing the American Astronomical Society, the California Institute of Technology, the Huntington Library, the National Research Council, and the International Astronomical Union. He attracted astronomers and physicists from all over the world to visit the Mount Wilson Observatory and Caltech, and he encouraged research efforts in almost every aspect of astrophysics. His notes and letters reveal that he recognized the problems of solar flares, solar influence on the earth's magnetosphere, stellar evolution, rotating and magnetic stars, the distances and sizes of galaxies, and magnetic fields in galaxies—all of them long before they became as popular subjects of study as they are today. For most of these, he proposed new observational techniques, such as motion pictures of prominences.

In summarizing astrophysical events of the years 1880 to 1950, as recorded in the many letters, journal notes, and papers of the Hale collection, Wright has provided a useful and fascinating account of scientific development that led to the preeminence of the United States. Hale's preoccupation with building and using the best possible instruments slants this account properly toward achievements in observation rather than in astrophysical theory. Readers with a background in physics and astronomy will recognize many of the important developments in solar physics, astronomical spectroscopy, and cosmology. Anyone who has prepared proposals for NSF, NASA, or other research grants will marvel at Hale's success in gaining support for his big ideas when he had to approach individual donors personally, taking account of their idiosyncracies and explaining later changes in plan. In these early years of "big money" research, C. T. Yerkes established his name with less than $800,000 for the observatory near Chicago, Andrew Carnegie with $10 million for the Institution that started the Mount Wilson Solar Observatory with $10,000, and John D. Hooker with $45,000 for the 100-inch telescope. Hale's meetings and correspondence with these wealthy men sound like excerpts from 19th-century novels, with their Victorian formalities and Edwardian innuendoes. In between, Hale presented papers on solar prominences and sunspots and their magnetic fields, wrote a book on stellar evolution, and received almost every scientific honor granted in the western world except the Nobel Prize (which is not offered in astronomy).

Because Hale's activities covered so wide a range, his biography could be written in many different ways. Wright has covered his contributions to astrophysics well and explained them in simple terms, illustrating her account with photographs and diagrams. Readers who know today's Chicago, Boston, Pasadena, or Washington will find many interesting accounts of life in these cities 40 to 80 years ago. Wright also emphasizes Hale's many friends, mostly physicists and astronomers whose names are now well known, and also biologists, chemists, engineers, geologists, architects, and archeologists—the inner fraternity of early 20th-century science. The nature of her basic material—letters, diary notes, reminiscences of relatives and a few old friends —leads to somewhat more emphasis than I would give on family illness and Hale's nervous disorders in 1910–1911 and may account for her neglecting certain aspects of his activities for the National Research Council in World War I. But there is an overall balance in *Explorer of the Universe*; it shows that George Ellery Hale was a man who picked significant things to do and then got them done.

THORNTON PAGE
Van Vleck Observatory, Wesleyan University, Middletown, Connecticut

Forest Problems in China

Forestry in Communist China (Johns Hopkins Press, Baltimore, 1966. 255 pp., illus. $6.95), by S. D. Richardson, is the story of Red China's forest problems and of her efforts to solve them. But even more, it is the story of a country which supports nearly one-quarter of the earth's peoples and is faced with the most gigantic land problem that history has ever recorded.

Richardson is director of research for the New Zealand Forest Service, and now visiting professor at the University of Wisconsin. In 1963, he toured China, conferred with forestry officials and other scientists, and obtained access to many of their records. The result is a timely and competent contribution to forestry literature. It is, in effect, the first comprehensive account of China's forestry activities and of her forest industries.

The book's objectivity is apparent on every page. Richards writes as one neither for nor against Communism. He is concerned solely with setting down facts, as he saw them and as he evaluates them, and their probable role in China's future. Yet, in a very real sense, the book deals with a problem more basic to China than Communistic ideology or military supremacy. It deals with the very source of life to China's teeming millions—water and land. For forestry, in its protective aspects, is probably of greater

importance to present-day China than to any country in the world. Even beyond her desperate and growing need for wood is the fact that her agricultural productivity depends on water conservation and, hence, on the afforestation of her denuded lands. Today the great part of China's natural forests has been destroyed, with the result that soil erosion is both acute and widespread and the shortage of forest products has to be experienced to be believed. So great is the demand for fuel wood alone that trees planted as part of her reforestation program are stolen almost as soon as they are put in the ground.

Richardson treats the many facets of China's forest land problem under such headings as "Economic background," "Natural vegetation," "Forestry administration and policy," "Water conservancy and protection forests," and "Education and research."

One of China's gigantic forestry projects is the "great green wall," the most ambitious protection-afforestation project ever undertaken by any nation. It consists of a series of massive shelterbelt systems which ultimately will form a more or less complete ring around the northern deserts. Richardson points out that China's forestry conservancy and protection-forests programs have been drawn up on a gargantuan scale and prosecuted with vigorous energy. Many mistakes have been made, many projects misdirected. Survival rate in plantations is probably poor, and widespread failure has been experienced. The Chinese recognize all this and are trying to avoid these blunders in the future.

The book is splendidly illustrated and contains a series of appendices and notes, together with a list of more than 100 arid-zone plant species, as well as a comprehensive bibliography.

This is not only a unique source of information hitherto unobtainable, but a vivid and convincing study of the greatest forestry effort known to history.

TOM GILL
International Society of Tropical Foresters, Washington, D.C.

Radiobiology and the Nervous System

Many books have been written about the effects of ionizing radiation on biological systems. Scant emphasis, however, is usually given to the role of the nervous system in radiobiological effects, since it is often thought that very large doses of radiation are necessary in order to affect the nervous system. During the past decade or two, however, it has gradually become known that behavioral responses can be elicited by millirad doses of ionizing radiation. Psychologists have found that radiation can be used as a stimulus; for example, moths may begin beating their wings shortly after being exposed to 0.1 r/sec of x-rays. Some effects of ionizing radiation are long-lasting; if a rat is presented with a single exposure to radiation at a time when saccharin is added to its drinking water, it will display an aversion toward saccharin solutions for several months thereafter. The physiological basis for such behavior is not known. Many animals have also been shown to respond to x-rays that impinge on the eye. Such reactions are probably due to fluorescence and depend on the state of visual dark adaptation.

Donald J. Kimeldorf and Edward L. Hunt, both of the U.S. Naval Radiological Defense Laboratory at San Francisco, have written **Ionizing Radiation: Neural Function and Behavior** (Academic Press, New York, 1965. 343 pp., illus. $10) in order to interest experimental physiologists and psychologists in the use of ionizing radiation as a research tool. The book is therefore organized according to the concepts of neurophysiology and behavioral science rather than those of radiation biophysics. The first chapter summarizes the properties of ionizing radiation and introduces radiobiological concepts, and the next is devoted to the function of the nervous system. The reader who is not familiar with this area of radiation research can become oriented rather quickly by reading these two chapters and then can pass on to any of the chapters dealing with particular effects of ionizing radiation on various portions of the nervous system and on gross behavior.

Because no overall theory has been formulated to account for the diverse effects of irradiation on animals, Kimeldorf and Hunt have presented a series of selected reports of investigations, together with their own speculations and hypotheses regarding the mechanisms that underlie the observed effects. They should be congratulated for their digest of the effect of ionizing radiation on neural function and behavior. It can be predicted that the level of activity in this interesting field of science will be materially enhanced as a result of this book.

L. M. BEIDLER
Department of Biological Sciences, Florida State University, Tallahassee 32306

Oxytocin Research

Advances in Oxytocin Research (Pergamon, New York, 1965. 162 pp., illus. $10), edited by J. H. M. Pinkerton, has a misleadingly broad title for a volume that contains the proceedings of a symposium about some limited aspects of oxytocin research. The symposium, which was held in London in May 1964, was sponsored by the Blair-Bell Research Society, a recently founded institution (1962). It brought together some well-known workers in the field of oxytocin research. The book is divided into two parts, Physiology and Pharmacology, and Clinical Applications. The first part includes a paper on circulatory effects of synthetic oxytocin, desamino-oxytocin, synthetic lysine-vasopressin and "Octapressin" (2-phenylalanine-vasopressin), as determined by the use of rubidium-36 to measure the regional blood flow. The rest of this part is dedicated to the problem of oxytocin concentrations in blood during lactation and parturition. The papers are by researchers from some of the laboratories in which the difficult problem of detecting and measuring circulating endogenous oxytocin is being systematically and thoroughly studied, and they are indeed worthwhile reading.

A paper in the second part of the book deals with endocrine control of labor, a controversial and unresolved problem that is further obscured by this presentation. Another paper is dedicated to the clinical use of oxytocin, administered by the transbuccal route, to induce labor. This contains much interesting information, but in several instances some study is needed to resolve apparent discrepancies in the numerical data. The number of cases of fetal distress (11 percent) appears to