Managing Motion

Vestibular and Brain Stem Control of Eye, Head and Body Movements. HIROSHI SHIMAZU and YOSHIKAZU SHINODA, Eds. Japan Scientific Societies, Tokyo, and Karger, New York, 1992. xii, 466 pp., illus. $264. From a meeting, Tokyo, May 1990.

Sensing and Controlling Motion. Vestibular and Sensorimotor Function. BERNARD COHEN, DAVID L. TOMKO, and FRED GUEDRY, Eds. New York Academy of Sciences, New York, 1992. xiv, 989 pp., illus. $190. Annals of the New York Academy of Sciences, vol. 656. From a conference, Palo Alto, CA, July 1991.

Vestibular and oculomotor physiology has been at the forefront of our understanding of sensory-to-motor transformations for many years. The major reasons for this are the inherent simplicity of eye movement mechanics and the accessibility of the motoneurons. Detailed descriptions of motoneuron behavior in awake, trained primates have been available for more than 25 years. Single-neuron recording studies have been paired with neuroanatomical tracing techniques, often focused on the same neurons, to yield rather detailed descriptions of both the signals and the connectivity that underlie eye movement control. Since in the oculomotor system the controlled variables are known to be eye position and velocity, in recent years a great deal of effort has been devoted to understanding how the appropriate control signals are generated. *Vestibular and Brain Stem Control of Eye, Head and Body Movements* provides a fine and up-to-date overview of this classical approach to vestibular and oculomotor physiology. With a few exceptions, the contributions are devoted to neuroanatomical description of the pathways involved in oculomotor control or the results of single-neuron recordings in awake animals. I particularly enjoyed the paper by Büttner-Ennever; the author's lucid writing style and vast experience with the topic have resulted in a fine overview of the connectivity of the paramedian brainstem cell groups, an area of great importance to oculomotor neurophysiologists. The papers by Henn and his colleagues on torsional eye movements are of considerable current interest in that they directly address questions about the means by which visual information must be transformed in order to produce the appropriate motor response.

Sensing and Controlling Motion, a rather massive tome with 114 papers, is the most up-to-date and comprehensive overview of the state of vestibular research that is currently available. The material presented is of formidable breadth, ranging from experiments designed to uncover the neurotransmitters involved in the vestibular pathways to recent advances in clinical vestibular testing. The volume is particularly strong in its description of recent work on the elucidation of the neurotransmitters involved in vestibular and oculomotor pathways (for example, the reader is referred to the excellent paper by Spencer and Baker). It is interesting to see this line of research so well represented here, as the vestibular system has long been the domain of those who do single-neuron studies in awake animals, an approach exemplified by *Vestibular and Brain Stem Control*. Indeed the vestibular and oculomotor systems lend themselves very well to attempts to bridge the gap between those who study neurotransmitters and membrane properties and those who use a systems approach, generally in awake primates. Since the connectivity

and behavior of the premotor neurons in the oculomotor system are very well understood, it is often feasible to record from cells in slice preparations whose behavioral properties have been well characterized in the awake animal. Thus it may be possible to relate membrane properties to normal function. Although such work is in its infancy, the potential is exciting.

Both volumes contain much new and exciting material and should be required reading for anyone with an interest in vestibular physiology.

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New Haven Observers

Astronomy at Yale, 1701–1968. DORRIT HOFFLEIT. Yale University, New Haven, CT, and Connecticut Academy of Arts and Sciences, New Haven, 1992. xviii, 230 pp., illus. $40. Memoirs of the Connecticut Academy of Arts and Sciences, vol. 23.

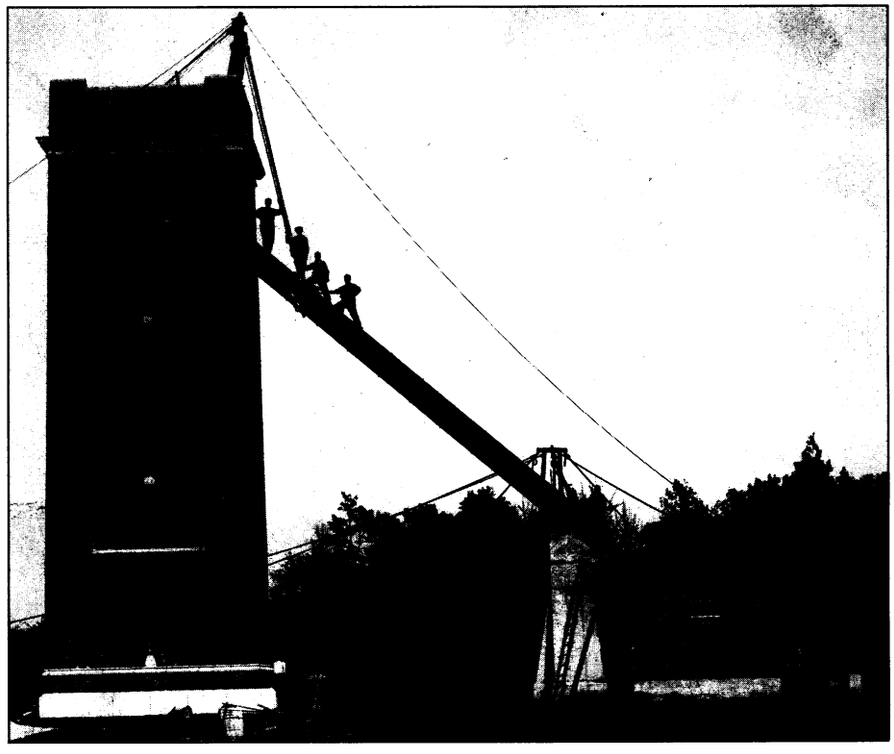
If you like celestial mechanics you will love this book. In fact if you like astronomy, you will find much of interest in it. It is a history of astronomy at one of the oldest universities in the United States, founded in 1701 as Yale College, the third in the colonies, after Harvard and William and Mary. The author, herself a professional astronomer now retired, tells her story largely in the form of a series of short biographies and reports on the research the Yale professors did. But Yale College began as a training school for ministers, and astronomy was one of the classical subjects they were expected to learn. The earliest students were allowed to choose whether to learn the Ptolemaic or the Copernican theory, that the sun revolved around the earth or vice versa. Gradually science took over.

The first recorded meteorite fall in the United States, in 1807, was investigated by Benjamin Silliman and J. L. Kingsley of Yale. Although Thomas Jefferson was supposed to have said "It is easier to believe that two Yankee professors would lie than to admit that stones could fall from heaven," they were right in their conclusions. Several later Yale astronomers, especially Dennis Olmsted, Edward C. Herrick (actually the college librarian and treasurer), Ellis Loomis, and Hubert A. Newton studied the orbits of meteors and fireballs, their connection with comets, their passage through the earth's atmosphere, and the meteorites that some of them became when they reached the ground. This work culminated in the meteor photography of W. L. Elkin in the first part of this century. Hoffleit, herself an expert in this field, describes their research carefully and accurately. She uses straightforward physical reasoning but gives quantitative details and references to very many of the published scientific papers, the primary sources for her book.

In its early years Yale had several significant astronomical firsts. In 1829 its new 5-inch achromatic telescope, obtained from the Dollond and Sons optical firm in London, was the largest refractor in America. In 1843 Arthur W. Wright received the first Ph.D. degree awarded in the United States, for his thesis on the computation of meteor orbits. Margaret Palmer entered the Yale Graduate School in 1892, the year it was first opened "to candidates without distinction of sex." In 1894 she became the first woman astronomer to receive her Ph.D. from an American university. Her thesis was the calculation of the definitive orbit of Comet 1847 VI, which had been discovered by Maria Mitchell, her undergraduate teacher at Vassar.

Closer to our time Ernest W. Brown, Frank Schlesinger, and Dirk Brouwer were the outstanding figures in Yale astronomy. Brown, born and educated in England, spent much of his life deriving and calculating the motion of the moon. In its most simplified form, this is the three-body problem of celestial mechanics, for the gravitational forces of the earth and the sun are both important. Brown's theory took every known force into account, including all the subtleties of the earth's form and orbit, as well as the perturbations of all the other planets. Frank Schlesinger, who became the director of Yale Observatory in 1920, developed astrometry, the precision measurement of stellar positions, parallaxes, and proper motions, into a fine art. His successor, Dirk Brouwer, who had come to Yale in 1927 from Leiden, was another expert in the celestial mechanics of the solar system. Much of his work was devoted to calculations of very accurate orbits of asteroids and planetary satellites. When the space era began in 1957 with the launching of Sputnik, he, his students, and his colleagues quickly became the leaders in solving the new problems of the orbits of artificial satellites and space vehicles.

Throughout this book Hoffleit emphasizes astronomical ideas and discoveries. It is highly concentrated on Yale, with little context of other observatories or universities, the wider world of science, America, or the world at large. Hoffleit writes gracefully and the book is copiously illustrated



Yale's Loomis telescope tower under construction, around 1915. Described in the 1915–16 Yale *Catalogue* as "a new type of instrument designed mainly for the photographic determination of stellar parallaxes," the Loomis telescope proved unsuitable for such work and "was eventually used for variable star observations." [From *Astronomy at Yale, 1701–1968*]