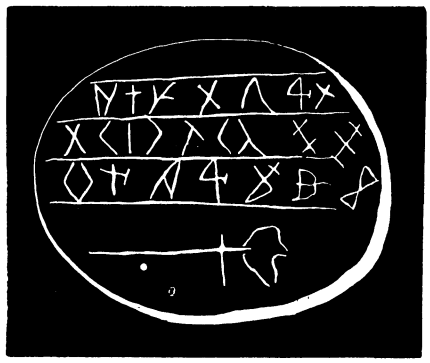
good night," which none of the characters in this book do. Michigan relics brought forth by William H. Scotford provide eyewitness views of the Deluge and the Tower of Babel, the symbolic episteme for most of early American archeology. However, after thoroughly demolishing the Viking Runestone discoveries, Williams does acknowledge, to this reader's relief, that the Vikings at least "were here" at L'Anse aux Meadows, where the evidence is incontrovertible. He does, however, describe in detail just how Harold Gladwin in *Men Out of Asia*, the story of the Polynesian discovery of America, kidded America's leading archeologist of the early 20th century, Alfred Vincent Kidder. Professor Cyclone Covey, an unlikely professor, struts his brief hour across the stage with the specious Tucson crosses; then there is best-selling Barry Fell, the Harvard professor of marine biology, and Professor George F. Carter of Texas A&M, who swear to the archaic authenticity of Mystery Hill, the North Salem archaic amusement park where Native Americans and colonial farmers probably lived, much like those who lived in Calendar II, a "megalithic" subterranean rock chamber in nearby central Vermont where a wooden lintel was recently dated at 200 years old. Fell and Carter too discovered "the Libyans of Zuñi." Fell's books, *America B.C.*, *Saga America*, and *Bronze Age America* (where there was no bronze), have sold well, and he has lectured widely. In fact, Williams's present treatise on the truth will probably never approach the popularity of Fell's works and is no match for the Psychic Archeology in which one sees visions of the past made popular by Frederick Bligh Bond, Stefan Ossowiecki, J. Norman Emerson, Jeffrey Goodman, Stephan Swartz, and the enormously popular Edgar Cayce. Who could match these giants of Fantastic Archeology? Their stories alone overshadow Williams's attempted account of what really happened in the peopling of America that forms the epilogue of this present book. The real drama of those early paleo-Indian peoples with their Folsom points, Clovis kill sites, and Midland Minnies seems prosaic beside the rogues' gallery of hoaxers. Barnum only scraped the surface when he said "there is one born every minute." How could he know how deep within the human psyche the rage for mystery and antiquity boiled?

Williams's book, though nearly exhaustive, is not perfect, however. It leaves out the U.S. Army's Topographical Engineers' discoveries and discussions of Canyon de Chelley, Zuñi, the Three Hopi Mesas, the Pecos ruins, and ancient Chaco Canyon, all done in the 1850s. These important finds raised the question whether the Southwest Indians were the advance guard of the Aztecs or whether these



The Grave Creek Stone, supposedly from a burial mound found in 1819 in what is now West Virginia, shown at approximately actual size. The inscription on the stone was variously deciphered as reading "The Chief of Emigration who reached these places has fixed these statutes forever," "The Grave of one who was assassinated here. May God to avenge him strike his murderer, cutting off the hand of his existence," and "What thou sayest, thou dost impose, thou shinest in thy impetuous clan and rapid chamois." [From *Fantastic Archeology*]

sites were mere steps on the road to Tenochtitlán, as Alexander von Humboldt speculated. Williams also credits John Wesley Powell with being head of the U.S. Geological Survey in 1879, when his friend Clarence King occupied that role until 1881. Also, Powell took no photographer on his first trip down the Colorado in 1869; but later, on his second trip, Jack Hillers, soon to be one of the West's greatest photographers, learned on the job when E. O. Beamon deserted the expedition. Williams also sees Cyrus Thomas and William H. Holmes as "myth-destroyers par excellence." It was Thomas who coined the absurd myth "rain follows the plow" and Holmes who stubbornly held up early man studies for nearly 20 years in perpetuating his "recent man" myth. No, Williams's book is not perfect, but it clearly reflects the fun that he has had teaching generations of Harvard students all about Fantastic Archeology and what to do when they venture forth into the wide, wide world of the "dig."

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Precision Teaching

Physics as a Calling. Discipline and Practice in the Königsberg Seminar for Physics. KATHRYN M. OLESKO. Cornell University Press, Ithaca, NY, 1991. xx, 489 pp., illus. $39.95.

Though much has been written about the shaping of physical theory and experimental method, we know far less about the shaping of physics teachers and their teaching methods. Nor is this neglect surprising, considering how little respect teachers traditionally receive in our society; yet without good science teachers, we would suffer not only a lack of scientists but a complete lack of general scientific literacy. From this perspective, then, it is worth taking a look at the kind of teaching that helped to make 19th-century Germany a leading scientific nation.

The title of Kathryn Olesko's well-researched and informative examination of this relatively neglected subject suggests her intersecting concerns. Olesko emphasizes that physics in those days was not just the profession it increasingly became, but a "calling," to which a student was ideally drawn by inner conviction and natural talents. To pursue such a calling required first of all discipline, which in the case of physics meant careful, systematic training in the observation of natural phenomena, in the controlled, accurate application of scientific instruments, and in the application of quantitative techniques including error analysis. This was the goal of Franz Neumann, director of the Königsberg University Seminar for Physics from its establishment in 1834 to his retirement in 1876. Using extensive primary sources, including Neumann's laboratory exercises, appended to an almost complete set of his annual reports to his superiors in the Prussian educational bureaucracy, Olesko devotes the bulk of the book to elucidating the evolution of Neumann's teaching. Her analysis brings out a seemingly "curious paradox" (p. 303); while Neumann's exercises were nominally designed to teach "theoretical" physics, they mainly focused on the perfection of experimental techniques that could close "the gap between what could be expressed mathematically [in theory] and what was actually realizable . . . under laboratory conditions" (p. 313). Neumann thus ultimately came to have "what might be called a predilection for [reducing] error over [arriving at new] truth" (p. 302), his fanatic pursuit of quantitative precision making him almost paradigmatic of one type of 19th-century physical scientist.

After discipline came practice. Olesko thus devotes her concluding chapter to the "ethos of exactitude" reflected in the subsequent work of Neumann's students, noting the theoretical and experimental weaknesses that in some cases arose when mathematical precision became an end in itself. She also shows how Neumann's methods eventually gave way to others placing less emphasis on error analysis. This discussion will be of particular interest to historians of the physical sciences. Of more general interest is

Olesko's penultimate chapter on the little-known "workaday world" of the secondary-school physics teacher, which was the career choice for nearly half of Neumann's students, many of whom successfully managed to carry on some research despite lack of time and facilities. In contrast, Olesko says almost nothing about the tiny fraction of Neumann's students who found careers in industry, which at that time had scarcely any jobs for physicists. Ironically, one of the formative influences on Neumann's own teaching was the astronomer Friedrich Wilhelm Bessel, who had come to science from a successful business career; he believed that strong science teaching was "the true foundation for arts and trade" (p. 30). Although Olesko does not explore this issue, one might ask how much the successes of late-19th-century German science-based industrialization were owed to graduates of those secondary schools in which Neumann's students and others like them taught the scientific spirit and discipline of precision for which German engineering became famous.

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Superfluid Vortices

Quantized Vortices in Helium II. RUSSELL L. DONNELLY. Cambridge University Press, New York, 1991. xviii, 346 pp., illus. $95. Cambridge Studies in Low Temperature Physics, 3.

Helium II, the liquid state of the isotope ^{4}He that occurs at temperatures below 2.17 K, contains a superfluid component that is the closest realization in nature of an ideal Eulerian (nonviscous) fluid. Moreover, He II supports vortices—localized string-like states of circulating superfluid having arbitrary length but only a single unique strength or circulation (that is, they are quantized, as befits an object existing within a macroscopic quantum state). Following Delphic remarks by Lars Onsager in 1949 and a more specific prediction of quantized vortices by Richard Feynman six years later ensued intense research involving some of the most difficult and imaginative experiments ever performed by "small" science. These were sometimes inspired and their results sometimes explained by equally imaginative and frequently adequate phenomenological theories. This book is a record of the 40 years after Onsager by one of the foremost practitioners of both experiment and theory, who was either on the spot or quickly arrived at most of the major events.

This is not a textbook, though there is a helpful review of classical and quantum fluid dynamics in the first two chapters that serves to introduce concepts. A course in introductory quantum mechanics together with one in hydrodynamics should enable a reader to follow most of the arguments (except in the later chapters, where the arcane nature of theories that use classical hydrodynamic reasoning at the level of an interatomic spacing requires statements like "The [omitted] details are somewhat tedious").

Nor is this a book on experimental or theoretical techniques—it is a catalog of results. More than that, it is a guide to and history of achievements. Donnelly does not overstate progress or gloss over difficulties: "A first principles quantum mechanical description of the vortex core in helium II has yet to be devised," or "the way breakdown [of ideal superflow] occurs is . . . obscure."

The book covers individual topics according to the historical progression of published work. Heavy emphasis is given to papers by Donnelly's students and collaborators, although the work of others is cited and sometimes described at length. There are no claims for completeness in literature citation or for authority in establishing priority. Puzzles and discrepancies that may exist are discreetly mentioned but not dwelt upon. Results are mostly presented in the language and notation of the original papers rather than being reworked to conform to some more general pedagogical or scientific schema. The tutorial introduction that often precedes a topic does not go beyond the results of the papers to be discussed.

The major topics are examined in six chapters: vortex dynamics and mutual friction, vortex structure, vortex arrays, vortex waves, superfluid turbulence, and thermal activation and vortex nucleation. These progressively longer chapters treat an impressive collection of subtopics. Absent topics include the controversial ac Josephson effect, vortex interaction with the free surface, radial counterflow in a rotating annulus, and tests of homogeneous nucleation theory using film flow. None of the formal mathematical progress on quantized vortices (involving diffeomorphisms, homotopy groups, Casimirs, and so on) is mentioned, since that work neither addresses data nor admits experimental testing. However, an attempt in applied mathematics to describe He II turbulence quantitatively is also omitted. An exception to the otherwise disciplined neglect of irrelevant subject matter is the four pages devoted to neutron stars.

The chronology of cited references shows that research activity on He II vortices is diminishing. This book thus serves as the summary of a natural period of research. Unlike supercurrent vortices in type II superconductors, or even vortices in superfluid ^{3}He, the He II variety have not become the basis of significant further development despite the equal precision of their quantization and their sensitivity to superflow. This underemployment stems from the lack of an intrinsic electromagnetic field, which makes He II vortex behavior difficult to measure and control. But nature's best "mechanical vacuum" and her simplest macroscopic quantum state with its quasi-classical vortex lines will continue to fascinate and especially to challenge those who would explain more complicated and less accessible systems. Expect no better book on the subject this century.

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Some Other Books of Interest

Taphonomy. Releasing the Data Locked in the Fossil Record. PETER A. ALLISON and DEREK E. G. BRIGGS, Eds. Plenum, New York, 1991. xiv, 560 pp., illus., + table. $95. Topics in Geobiology, vol. 9.

Since the appearance in 1972 of an English translation of Wilhelm Schäfer's classic treatise *Aktuo-paläontologie nach Studien in der Nordsee* (see *Science* **179**, 675 [1973]; also **246**, 1505 [1989]) studies of the processes that determine how organisms are preserved as fossils have coalesced under the rubric of taphonomy. This enterprise has now, as the editors of the present volume note in their preface, advanced beyond the stage of descriptive paleontology to become an interdisciplinary analytic enterprise. Its various current concerns are represented in this collection of reviews. After an opening outline by Logan *et al.* of "molecular taphonomy"—the preservation of nucleic acids, proteins, carbohydrates, lipids, and other biomolecules—the editors themselves survey the preservation of nonmineralized (soft) tissues and wholly soft-bodied organisms, discussing a number of *Konservat-Langstätten* (deposits characterized by exceptional preservation such as the Burgess Shale). A consideration by Spicer of taphonomic processes affecting plants, which present special difficulties because they are seldom preserved whole, is followed by two extensive treatments of shelly faunas—Kidwell and Bosence on temporal and spatial fluctuations ("time-averaging") and Kidwell on stratigraphic issues. Behrensmeyer then