this purpose—no mean feat for the instrument-maker. By way of contrast, David Wilson of Dublin used as the sensing vessel the urinary bladder of a rat. Such was his success that he made hundreds of these hygrometers, and in the process he discovered quite incidentally that "London rats are very subject to urinary calculi which I do not find to be the case in other towns." Middleton allows this may be the result of the rat race.

Another example of sensors selected from our organic environment is the wild oat. The famous Robert Hooke used the beard of an oat as the sensor for a hygrometer. The spiral fiber in the center of the oat twists and untwists with changes in humidity, and it was not difficult for one with Hooke's talents to incorporate it in a successful indicating instrument. One is constantly reminded as the pages go by that there are, so to speak, many ways to skin a cat and an incredible number of them have already been tried. How many more can there be?

It would be inappropriate, even in a short discussion about the invention of meteorological instruments, not to mention those ingenious ancestors of the modern automated weather-observing station, the weather clocks. Christopher Wren and Robert Hooke were very much involved in their early development. A quotation from *Journal Books,* 9 January 1678/9, describes well their function: they were

> . . . made to keep an Account of the Quantity and kind of all the Changes that happen in the Air as to its heat and cold, its dryness and moisture, Its gravity and Levity, Its motions in what Quarter and with what strength and Velocity, As also of the kinds and Quantity of the Rain, Snow and hail that falls all which it sets down in Paper, so as to be very legible and certain.

For about 200 years meteorographs of remarkable complexity were built and installed in observatories and elsewhere. Middleton explains their final demise as follows:

> . . . there were two reasons for this. In the first place it was just beginning to dawn on a few meteorologists that the rapid spatial and temporal fluctuations on the meteorological elements put a limit on the desirable or indeed attainable precision of measurement. The second was the introduction in the 1880's of a series of small, light, and inexpensive recording instruments by the Paris firm of Richard Frères. The great meteorographs, like the huge reptiles of the Jurassic era, simply could not compete.

So the small, efficient meteorograph was born. It is interesting that miniaturization, a hallmark of much contemporary instrumentation, was an accomplished fact in meteorographs before the beginning of this century. The desire to sound the atmosphere with kites and small unmanned balloons provided continuing impetus for this development. And by 1906 W. H. Dines of Great Britain had produced excellent meteorographs (recording temperature and pressure) that weighed only 28 grams.

The book is generously and beautifully illustrated with everything from rough woodcuts to fine engravings. At first glance it might be mistaken for a text on the history of scientific illustration. There are 224 figures, a ratio of two for every three pages.

The story ends with the Second World War, at a point in time where personal recollection begins to serve as makeshift historian for many of us. One can only hope that another "knowledgeable pen" will come along to continue Middleton's scholarly record.

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A 17th-Century Figure

John Wilkins, 1614–1672. An Intellectual Biography. BARBARA J. SHAPIRO. University of California Press, Berkeley, 1969. xii + 336 pp. $9.50.

One of the better ways to approach a complex and remote period is to fasten upon a single, key individual and follow his evolution as a mirror of the times. Bishop John Wilkins (1614–1672) was one of those men at the center of the intellectual currents of the 17th-century scientific revolution whose lives repay careful consideration in this light. Anthony à Wood, a contemporary biographer, reported that Wilkins "was a Person endowed with rare gifts," being "a noted Theologist . . . an excellent Mathematician and Experimentist," as well as one well versed in astronomy, mechanics, and the new philosophy "of which he was [as] great [a] Promoter as any of his time."

Barbara J. Shapiro has undertaken the difficult task of attempting to synthesize the varied interests of this ingenious and industrious man. She has succeeded in putting together, in a highly professional way, a coherent and well-written account of Wilkins's intellectual activities and relations with his contemporaries. In structure, the book presents few surprises: it recounts (briefly) Wilkins's early life, his early scientific writings, his years as Warden of Wadham College, Oxford, and the prehistory and early years of his Royal Society career and, finally, records Wilkins's last views on science and religion.

Shapiro is, however, after bigger game than this brief outline implies. She is aiming at no less than the resolution of a knotty debate that has been troubling historians of science for a generation. In the 1930's the sociologist Robert K. Merton advanced the view (similar to the Weber-Tawney thesis) that puritanism and its ethic were intimately connected with the rise of science in England and elsewhere. Since that time the debate has flared intermittently and appears only now to be exiting, not so much solved as agreed to be insoluble. Shapiro offers a different "science and religion" view, that moderate religion (latitudinarianism) and not puritanism is the key that opens doors to the understanding of the origins of modern science. The case made is a good one—even a moderately convincing one. It suffers (and benefits) from the same disability as the puritanism thesis: the definitions of "puritan" and "moderate" remain too diffuse for close application. The historical connections that must be made for a fully satisfactory argument have yet to be completed.

Shapiro's biography of Wilkins is a solid, conventional one, although it may seem, to some, a trifle pallid compared with such recent scientific biographies as Manuel's *Portrait of Isaac Newton.* For historians of science it may have, moreover, an air of quaintness. With the major exception of the puritanism-and-science issue and a few minor ones, we are transported back to the literature, concerns, and debates of a generation ago. A great deal has happened in the last 10 or 15 years of history-of-science scholarship, and very little of it is reflected here. One small example: Shapiro's view of Wilkins's controversies with Dell and with Webster on university reform in the 1650's might well have been altered had she confronted recent work by P. Rattansi, A. Debus, and others concerning Paracelsianism in England. A larger issue is at stake here, however. Latitudinarian science was forced to deal not only with Aristotelianism but also with the sectarians' romance with alchemy and "illuminating" experience. It is, perhaps, Shapiro's reluctance to face the latter that provides the book's major unfinished business.

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Prehistory of an Island

The Archaeology of Martha's Vineyard. A Framework for the Prehistory of Southern New England. A Study in Coastal Ecology and Adaptation. WILLIAM A. RITCHIE. Published for the American Museum of Natural History by the Natural History Press, Garden City, N.Y., 1969. xviii + 254 pp., illus. $15.

Six shell middens and 13 radiocarbon dates provide the author with the principal evidence from which he seeks to generalize "the major aspects of the prehistory of Massachusetts, Connecticut and Rhode Island, and to relate the adjacent, and much more fully known, New York State." Readers familiar with Ritchie's reconstruction of the prehistory of New York State (where he is state archeologist) will find familiar cultural sequences with additional correlations from coastal manifestations.

Four horizons discerned in most of the sites are distinguished by color and shell components. Prior studies by Byers and Johnson (1940) disclosed closely similar features to the sites reported here. A suggestion of an original podzolic surface at the base of the Hornblower II midden is described, but for the other sites the original surface is not recorded. Ground plans showing excavated features and site boundaries are presented with section profiles indicating the stratigraphy of each site.

Only a single and apparently casual burial was located in the partial excavation of the six sites reported.

An admirable analysis of the shell and bone artifacts by J. H. Waters provides detail on the diet of the people who occupied these sites from about 4200 years ago up to the earliest contact with Europeans. Although the principal animal whose remains were found in the midden debris was the white-tailed deer, bone fragments indicate that raccoon, black bear, fox, dog, beaver, muskrat, varieties of duck, geese, turkey, and swan, in addition to seal, porpoise, bluefish, striped bass, tautog, scup, and cod, were utilized. In most levels of the sites, the predominant shellfish are the quahog (*Venus mercenaria*) and the bay scallop (*Pecten irradians*). The inhabitants also gathered quantities of the soft clam, long or razor clam, oyster, mussel, boat or slipper shell, and occasional specimens of moon shell, whelk, and conch. Changes in shell-type abundance in the various levels of the sites are attributed to overfishing or changing salinity as a result of sea level changes. Very few plant remains were recovered from any of the sites. Ritchie's explanation of the preponderance of quahog in the middens as being due to the ease of recovering them "lying exposed on the bottom" is not accurate, for the animal is usually found in vertical position with both valves buried from ½ inch to 8 inches and only the siphons protruding.

Of 18 charcoal samples submitted for radiocarbon analysis, 13 proved acceptable to the cultural sequence inferred by Ritchie. In an introductory statement the author says that "because here for the first time in this area of New England, interpretation and hypothesis on this scale are attempted, it is patently required to offer the supporting data of the site excavations. . ." To say the least, it would have been more scientific to include conflicting evidence as well, "for the critical student, so that he may evaluate the evidence for himself." Of seven radiocarbon samples at the Vincent site, which is inferred to have been occupied nearly continuously for the last 4000 years, only two determinations were deemed acceptable, and the other five dates are not described. Because of the shallowness of the deposits, all radiocarbon dates from middens are inherently suspect because of possible contamination from contemporary rootlets which preferentially invade charcoal (largely because of the ability of charcoal to retain moisture in these otherwise coarse-textured deposits).

The problem of sea level rise in this part of coastal New England is crucial to any interpretation of the prehistory of Martha's Vineyard. Evidence from New Jersey and even Connecticut is largely irrelevant because of differential isostatic rebound coupled with eustatic changes in sea level. Estimates derived from radiocarbon dates of organic deposits indicate only the time at which rising ground water levels (backed up by rising sea levels) intersected the base of depressions within which the deposits accumulated. The succession of "coastal tradition" sites described by Ritchie may simply reflect the distance early people were willing to carry shellfish prior to opening and eating them and discarding the shells. The lack of dates older than 2270 ± 160 B.C. (Y-1530) obtained from Stratum 4 of the Hornblower II site may therefore indicate only the time at which rising sea level made carrying shellfish to that location practicable. Despite the fact that this was the oldest site found on Martha's Vineyard, only 13 squares in a grid of 77 five-foot squares covering approximately 50 percent of the estimated site area were excavated. Several middens known to the reviewer along Squibnocket Head have been exposed and destroyed by cliff retreat (the average rate of which is 4 to 6 feet a year). It is entirely possible that older sites have been submerged or destroyed by rising sea level and shoreline retreat.

Despite attractive format and copious illustration of sites, excavation stratigraphy, and artifacts, six similar sites with 13 radiocarbon dates make slender reeds from which to construct "a framework for the prehistory of southern New England."

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Effects of Radiation

Molecular Photobiology. Inactivation and Recovery. KENDRIC C. SMITH and PHILIP C. HANAWALT. Academic Press, New York, 1969. xviii + 230 pp., illus. $10. Molecular Biology.

This book is an outgrowth of a course taught by the authors at Stanford University. Its main purpose is to provide sufficient information for an understanding at the molecular level of the biological events that occur following the interaction of ultraviolet light with the proteins and nucleic acids of simple systems such as viruses and bacteria. It was not the authors' intention to provide a comprehensive review of photobiology; they have tried instead to write a book that would be useful for students in various disciplines from biology to physics.

Although the book is relatively short,