

The critical reader of this essay cannot help having two distinct reactions. First, it is extremely difficult to define exactly what characterizes the pseudo-biological "eclosion," much less the "synthesis" of a later age. Indeed, the author all but says as much when he declares that "the Age of Eclosion was so sweeping and potent in its achievements that it even produced our eventual notion of Synthesis." And, as might be expected, this "notion of Synthesis has an affinity to the renowned triad, thesis, antithesis, and synthesis, of the philosopher of history Friedrich Hegel." Second, on every topic he takes up Bochner presents a variety of new insights that will inform and challenge all philosophers and historians of science. I found particularly brilliant chapter 14, "The problem of the size of the universe," the three chapters on space ("... in knowledge and the arts"; "... before the Age of Eclosion"; "... and geometry since eclosion"), and chapter 5, "Psychology and pedagogy."

Much attention is given to Newton, who appears prominently in a number of chapters. As one would expect from a distinguished mathematician such as Bochner, who has shown us his talents for historical-philosophical studies, the discussions of the Newtonian and post-Newtonian traditions in mathematics and mathematical physics are extremely valuable. For instance, comparing the intense activities in developing fluid mechanics in the post-Newtonian century with a lack of major advances in optics in the same period, Bochner wisely castigates those who explain the latter by reference to Newton's influence and his failures without being aware that the situation in fluid mechanics would show the unsoundness of an argument of this sort. With regard to Newton, however, I believe Bochner would not so have insisted on Newton's "syllogistic mathematization of his mechanics" had he studied Newton's treatment of the general problems of motion, "supposing a centripetal force of any kind, and granting the quadrature [= integration] of curvilinear figures . . ." (*Principia*, Book I, Props. XXXIX-LXI). Here, especially, the geometric mask does not really hide the essentially analytic character of Newton's presentation.

The personal charm of the author's style matches the incisiveness of the comments. My favorite remark occurs on page 31, in relation to the new electronic digital computers, which cause the author to "admit (reluctantly perhaps) that the nascent theories of com-

munication, information, control, coding, and so forth, inject into our intellectuality a certain factuality whose range of effectiveness cannot yet be circumscribed." He concludes that, "although the machine of the Age of Eclosion only wanted to supplement and outdo man's brawn, the novel machine of the Age of Synthesis wants to supplement and outdo man's brain. I regret that I will not be alive in the twenty-first century to know the ultimate outcome of this match between new-fangled factuality and old-fashioned intellectuality."

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Instruments and Their Use

Optical Methods in Biology. ELIZABETH M. SLAYTER. Wiley-Interscience, New York, 1970. x, 758 pp., illus. \$29.95.

The aim of the author is to present a single and unified account, suitable for a graduate course in optical instrumentation or as a reference for the working scientist, of optical principles that are important for biological research. The book is not written to be a treatise on design, an account of the state of the art, or a handbook of techniques or of what has been discovered by the application of the optical methods.

The amount of material covered is impressive. Light, lenses, x-rays, and electron microscopes are allotted over half of the book. Other microscopes, monochromators, spectrophotometry, luminescence, and other aspects of the subject are treated less adequately. The mathematics has been kept as simple as possible, but equations occur throughout the book, and the reader is assumed to be able to use them. The book is compiled from standard textbooks and many of the references at the ends of the chapters are to these textbooks or the *Scientific American*. Few papers from the literature are cited, nor is the reader referred to primary source books for particular instruments. The treatment is that of physics; the biologist must make his own interpretations.

For microscopy, Abbe's theory is used with no reference to recent work on problems of resolution. Bereck is listed in the index and referred to via Martin's book. Köhler's name is mis-

spelled. Depth of focus and field are treated solely as physics with no mention of the role of accommodation of the observer's eye. Phase microscopy is explained by the vector method rather than by the general equations. Two of the four types of diffraction plates are described. The older types of interference microscopy are briefly considered, but the small shearing differential method and its special form of contrast are omitted. The addition of references to the basic books could have brought the chapter on interference microscopy more nearly up to date.

Electron microscopy receives more detailed coverage, likewise the polarizing microscope. A reference to Shurcliff's *Polarized Light* would have been appropriate and useful.

It is unfortunate that the S.I. units are not used. The lumen is defined, with an error of 10, in terms of the candela, which the author calls candle. On page 506, brightness is a property denied for a surface. The concept of luminance would help the author's problem that units of illumination tend to be confusing. She should use the U.S.A. Standard Z7.1-1967.

Slayter's book should be a useful review for the graduate student of optical instrumentation. Such a student may be annoyed when the descriptions get complicated and he is referred back to Jenkins and White, Strong, or other classic texts. For the scientist looking for an equation or a brief explanation of a principle the book should be useful. The biologist who likes his physics straight should enjoy it. As a biologist, I prefer more detailed books on the special instruments which have some relation to their biological use.

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Books Received

Automation and Data Processing in the Clinical Laboratory. Proceedings of a symposium, San Francisco, February 1969. Geoffrey M. Brittin and Mario Werner, Eds. Thomas, Springfield, Ill., 1970. x, 174 pp., illus. \$13.50.

Biology of Plants. Peter H. Raven and Helena Curtis. Worth, New York, 1970. xii, 708 pp., illus. \$11.95.

Biology Teachers' Handbook. Evelyn Klinckmann, Supervisor. Wiley, New York, ed. 2, 1970. xviii, 698 pp., illus. \$8.95. Biological Sciences Curriculum Study.

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