

authors is strongly embryological, morphogenesis and differentiation being the central themes. Tissue interactions (including interspecific interactions), the study of which has contributed much to the understanding of morphogenetic mechanisms, and the effects of environmental factors, including those of hormones and teratogens, on differentiation are extensively covered. The wide diversity of organs and combinations of organs from mammalian, avian, and invertebrate sources studied is impressive. Among the most significant accomplishments documented here are the analyses of the effects of dissociation and reassociation of organ rudiments on differentiation and morphogenesis. The culture of gonads, and of secondary sex structures, has been one of the most substantial contributions of the Paris group to our knowledge of sexual differentiation and intersexuality. This book provides indispensable background for those who want to explore and exploit the potentialities of in vitro systems for the solution of morphogenetic problems.

The translation is for the most part excellent, though nuances are occasionally lost. The illustrations are good but lack some of the sharpness of reproduction of those in the original French edition.

CHARITY WAYMOUTH

*The Jackson Laboratory,  
Bar Harbor, Maine*

## Teaching Science as Enquiry

**A Strategy for Education.** HERMAN T. EPSTEIN. Oxford University Press, New York, 1970. x, 122 pp., illus. \$4.95.

A tension between the teaching of science as a rhetoric of conclusions and the teaching of science as enquiry has existed, doubtless, since Galileo presented one of his major works in the form of a dialogue. At any rate, in the early 19th century, Auguste Comte could remark with no air of originality that

Every science can be viewed according to two modes of development—the historical and the dogmatic. According to the first, one considers the science successively, following the order by which the human mind has really acquired the knowledge. . . . According to the second, one presents the system of ideas as they would be conceived today by a mind which . . . is concerned with remaking the science as a totality.

Comte goes on to remark that the first mode treats original works (research papers) with primary emphasis on the manner in which the science has been formed.

In 1937, the University of Chicago refurbished the idea of making research papers accessible to beginning undergraduate students, using them as exemplars of scientific research and as occasions for participation by students in some of the activities of scientific enquiry. A report of this extensive experiment, including a bibliography of some 60 research papers in six series used and tested in the program, is contained in *The Idea and Practice of General Education* (various authors, University of Chicago Press, 1950). In 1950 the University of Puerto Rico launched a similar endeavor on a substantial scale, and currently such schemes are used occasionally or systematically in a number of colleges and universities. Indeed the use of original papers in the social sciences is so widespread that one publisher (Bobbs-Merrill) has made reprints of some 1100 papers available in loose-leaf form.

In the Inglis lecture delivered at Harvard in 1961, I argued for a similar treatment of science at the high school level (*The Teaching of Science*, Harvard University Press, 1962) and described a number of alternative means for doing so. The Biological Sciences Curriculum Study adopted one of these, "Invitations to Enquiry," and published 44 such "Invitations" together with suggestions for their use by high school teachers (*Biology Teachers' Handbook*, Evelyn Klinckman, Ed., Wiley, 1963, pp. 45–226). More recently, the Elementary Science Study has developed and published a large and varied body of material, much of it highly ingenious and extremely sensitive to the needs and limitations of very young students, all of it designed to bring activities of enquiry to students at the elementary level (Webster Division, McGraw-Hill, various publication dates).

This highly incomplete review is by way of saying that Herman Epstein has apparently rediscovered, quite independently, two of the principles which generate these varied efforts. He has rediscovered the extent to which participation by students in the solution of significant problems challenges many of them to renewal of interest and marshaling of energy. He has rediscovered also that primary sources (research papers) constitute accessible oc-

casions and effective springboards for posing problems of scientific enquiry and inviting participative solution. In his slim volume (81 pages plus 41 pages of appendices) he presents one pattern of instruction for realizing these principles. The collegiate teacher of science unfamiliar with such modes of instruction may find the work suggestive. He is warned, however, that there are numerous alternatives to the kind of material and pattern of instruction suggested by Epstein and a great many issues involved in the curricular choices among them that are entirely omitted from Epstein's treatment.

JOSEPH J. SCHWAB

*Department of Education,  
University of Chicago,  
Chicago, Illinois*

## Books Received

**Active Filters.** Lumped, Distributed, Integrated, Digital, and Parametric. Lawrence P. Huelsman, Ed. McGraw-Hill, New York, 1970. xii, 372 pp., illus. \$16.50. Inter-University Electronics Series, vol. 11.

**The Analysis, Design, and Synthesis of Electrical Filters.** DeVerl S. Humpherys. Prentice-Hall, Englewood Cliffs, N.J., 1970. xii, 676 pp., illus. \$18.95.

**Annual Reports on NMR Spectroscopy.** Vol. 3. E. F. Mooney, Ed. Academic Press, New York, 1970. xii, 506 pp., illus. \$19.50.

**Automated Cell Identification and Cell Sorting.** George L. Wied and Gunter F. Bahr, Eds. Academic Press, New York, 1970. xii, 404 pp., illus. \$19.50.

**BASIC.** For Beginners. Wilson Y. Gateley and Gary G. Bitter. McGraw-Hill, New York, 1970. xviii, 152 pp., illus. Paper, \$3.95.

**Basic Engineering Sciences and Structural Engineering for Engineer-in-Training Examinations.** H. Jack Apfelbaum and Walter O. Ottesen. Hayden, New York, 1970. xvi, 408 pp., illus. \$13.95. Professional Engineering Examination Series.

**Basic Statistical Methods.** N. M. Downie and R. W. Heath. Harper and Row, New York, ed. 3, 1970. xii, 356 pp., illus. \$9.95.

**Behind Ghetto Walls.** Black Families in a Federal Slum. Lee Rainwater. Aldine, Chicago, 1970. xii, 446 pp., illus. \$12.50.

**Biological Studies of the English Lakes.** T. T. Macan. Elsevier, New York, 1970. xvi, 260 pp., illus. + plates. \$13.

**Brown Adipose Tissue.** Olov Lindberg, Ed. Elsevier, New York, 1970. xiv, 338 pp., illus. \$24.50.

**Cell and Tissue Culture in Biology and Medicine.** A symposium, Edmond, Okla., December 1969. Paul F. Kruse, Jr., Ed. Oklahoma Academy of Science, Norman, 1970. vi, 102 pp., illus. Paper, \$5. *Annals of the Oklahoma Academy of Science*, No. 1.

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