

treatments of extremely important phenomena in the life of plants, and they reveal a field of investigation that has received relatively little attention elsewhere. But, unfortunately, the third section contains a reiteration of the Lysenko theme of the inheritance of acquired characters. This is exemplified by the following quotation (page 222), "All hereditary changes in hardness begin with the so-called phenotypic changes in individual development. If they arise in young cells, they become fixed in the individual development of the organism in all its parts or in specific organs depending on what develops from these cells. If changed cells become the source of sexual or vegetative cells from which new organisms originate, the newly acquired hardness is transmitted to the offspring." An examination of the separate bibliography of foreign authors reveals no references on genetics after 1944, although the Russian edition of the book appeared in 1956, and the text certainly gives no evidence that the author is conversant with modern interpretations in this field. Despite these lapses in the field of genetics, this volume constitutes a distinct contribution to the field of plant physiology.

Although the committee is to be commended for this initial effort, one might suggest that future translations should have editorial comments that supplement, clarify, or correct the Russian text.

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Theory and Practice

Work-Study Programs. Appraisal and report of the study of cooperative education. James W. Wilson and Edward H. Lyons. Harper, New York, 1961. xii + 240 pp. \$3.50.

Although the first college program in cooperative education (alternating periods of work and study) was initiated at the University of Cincinnati in 1906, the first comprehensive survey and evaluation of the results has just been made. Financed with foundation grants and planned by a nationwide committee of educators, the 240-page report, cited above, has now been published.

The survey was an intensive one involving selected colleges of liberal arts, business administration, and engineer-

ing, each of which was paired with a similar institution that had not used the cooperative plan. Data were gathered from students, faculty, and employers.

The findings are favorable toward the work-study idea; recommendations include those for improving and for extending the programs. The quotation from the introduction, by Ralph W. Tyler, chairman of the study committee, catches the optimistic tone of the report:

"Cooperative education has important values for colleges and universities, for students and employers. These values should be given wide publicity and cooperative programs in American higher education should be greatly extended" (page 14).

A few of the committee's conclusions may be of special interest:

"The academic potential of cooperative students is equal to that of non-cooperative students" (page 155).

"The cooperative experience provides meaningful opportunities for the student to see the relevance of theory to practical situations and affords him opportunities to practice making applications. . . . It is the judgment of the committee and staff that this study lays to rest suspicion that cooperative education is anti-intellectual and over-practical" (pages 155-156).

"Cooperative education makes a positive contribution to society by attracting able young people to college who might otherwise never consider continuing their education beyond the high school" (page 156).

". . . the cooperative plan makes possible the more effective utilization of college facilities" (page 157).

An evaluation of any educational program is extremely difficult to make. For example, students and alumni tend to be biased in favor of whatever institution and type of program they attend. Hence the comparisons made on the basis of opinions do not reveal the full strength of the program in question. Subscribing as I do to the theory of the educative value of experience as advocated by Pestalozzi, Froebel, Dewey, and others, I believe the findings understate the values of the cooperative plan. The plan has significance for liberal education beyond that found in this study, which did not examine the liberal arts program as fully as it did the two more applied fields.

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New Approach

Industrial Dynamics. Jay Forrester. M.I.T. Press, Cambridge, Mass.; Wiley, New York, 1961. xv + 464 pp. Illus. \$18.

Industrial Dynamics represents a radically new and different approach to the problems of industrial management. The author attempts to provide a common framework for the separate functional areas of management activity (production, marketing, engineering, and the like), in terms of flows of money, orders, materials, personnel, and capital equipment, all integrated by an information network. To accomplish this he developed a methodology for building mathematical models of industries or firms and a computer program to compute the complex interactions of the models. By varying inputs on the computer runs, the technique is supposed to reveal critical system variables that can then be manipulated to achieve better results in the management of an enterprise.

One strength of the approach advocated by Forrester is that he has not succumbed to the current craze of mathematical elegance for the sole sake of elegance. The parameters and constants used have meaning in the real world modeled, and he has not fallen into the trap of making unwarranted assumptions and elaborating on them. The concepts and techniques are not beyond the comprehension of a good engineering or science undergraduate.

The book provides the tools for the interested reader to challenge old management clichés, myths, and shibboleths—the author is an industrial iconoclast. Indeed, in the core analysis of a hypothetical production-distribution system, Forrester shows that "small changes in retail sales can lead to larger swings in factory production," owing to the internal characteristics of the system itself. This model also disclosed that "reducing clerical delays may fail to improve management decisions significantly," that "a factory manager may find himself unable to fill orders although at all times able to produce more goods than are being sold to consumers," and that "an advertising policy can have magnifying effect on production variations."

This book's major shortcoming is the lack of confirming data from the organizations modeled. For example, a model of an electronics firm produced evidence that a violently fluctuating