tions and the general scheme of industrial instruments. Little practical information is given except that which is available in instruction manuals. High-resolution instruments, microelectrodes, carbon dioxide tension, and the Na^+ and K^+ electrode systems are not mentioned.

In the chapter on ultraviolet and visible absorption spectroscopy the basis, form, and functions of commercial spectrophotometers are presented. Fluorescence and flame photometric methods are only briefly mentioned. Other emission methods and atomic absorption are not included.

In some 33 pages on infrared absorption spectroscopy, Clara D. Smith presents a succinct review of the elements of infrared absorption methods and their value in biochemistry. A chapter entitled "Manometric devices" presents classical Warburg techniques in 11 pages, with no mention of Cartesian diver methods. In the chapter on osmotic pressure measuring devices, some classical methods are described but instruments that have been available for several years are not considered.

A chapter on transducers and one on read-out devices are concerned with what is generally conceded to be instrumentation in that the physical basis and limitations are given for a number of important transducers in current use. Measurement of nuclear radiation is treated only in relation to the elementary principles of the transducers. The instrumentation of scintillation counters, pulse-height analyses, and data handling are omitted. Discussion of solid-state devices and the consequences of their availability in modern instrumentation is conspicuously absent.

In the chapter on read-out devices digital devices are mentioned but no distinction is made between digital computers that handle the data in digital form and those that use an analog method and present the data in digits derived from the analog function.

The effort to provide a book on instrumental methods for the biologist is commendable, but the scope of the field is so great that any rational effort must involve selection which, I feel, should have been more discriminating. The book should have been more suitably titled.

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A Collection of Mathematical Problems

The Pleasures of Math. A. W. Goodman. Macmillan, New York, 1965. 224 pp. Illus. $4.50.

The principal attraction of this book is an extensive collection of problems that range from the extremely simple to the very difficult. The author has made a nice selection of topics that should be stimulating to those high school and beginning college students who wish to supplement their mathematics studies. However, those who wish to supplement their study of trigonometry, probability, or calculus must look elsewhere.

Goodman says that he has aimed at four classes of readers: high school students, high school teachers, college students, and parents. I do not think that he will carry along many of the last group. The author states that "a student who finishes this book . . . is fully prepared to start calculus." One might question this assertion in view of the omission of trigonometry and the slight attention given to analytic geometry. However, his primary purpose seems to be to entertain, and he has achieved this quite well.

Some statements may lead to misunderstanding: for example, "Not all inequalities involving a positive integer n require mathematical induction"; "if this assertion is not obvious, it can be proved by mathematical induction"; and "we have proved this principle (of mathematical induction)." Terms such as "smaller" polygon, "dominant" term, and "series" appear without definition. The definition of "divisor" does not exclude zero and the prime factorization theorem does not exclude one. The fundamental principle of counting is "proved" and extended to k factors without mathematical induction. The greatest common divisor is discussed without reference to the Euclidean algorithm.

The book (224 pages) includes an index, a bibliography of 30 titles, and answers to all the problems. Magic squares, the four-color problem, conic sections without coordinates, extremes without calculus, and the theory of numbers are discussed. The 35 sets of problems form the major contribution of the book.

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Economics: Agriculture and Economic Development

Economic Crises in World Agriculture. Theodore W. Schultz. University of Michigan Press, Ann Arbor, 1965. viii + 114 pp. $3.50.

In the four chapters of this book, Theodore Schultz examines the role of agriculture in the economic development of less-developed and developed countries. He treats the matter in terms of two agricultures. One is the "traditional" agriculture characterizing less-developed countries. Another is the "modern" agriculture characterizing the developed countries, especially the United States.

Schultz's thesis is that, within both the traditional and modern agricultures, there comes a juncture in economic development wherein a stagnant and depressed agriculture causes a crisis. However, the crises within the two agricultures are wholly different. The book is devoted to examination of causal factors generating these crises and to possible avenues of escape.

The two initial chapters, drawing heavily upon his earlier book *Transforming Traditional Agriculture* [Yale University Press, 1964; reviewed in *Science* **144**, 688 (1964)] deal with the nature and explanations of the crisis within agricultural sectors of less developed countries. The third chapter appraises the efforts made by the United States to assist less-developed countries in their efforts to modernize their agriculture. The fourth and final chapter examines the nature and possible explanations of the crisis in modern agriculture, with special reference to the United States.

Within the traditional agricultures, Schultz concludes that their serious food shortages can be solved only through large increases in agricultural production and marked declines in population growth. Aside from noting the retarding consequences of population growth on improvement in food supplies, Schultz leaves the population question and concentrates on in-

creased agricultural production. In searching for impediments to increased agricultural production, Schultz examines and rejects land and capital shortages, limitations resulting from farm size, and allocative efficiency and omits consideration of structures and infrastructures. He concludes that the major impediment is the low rate of return on investment which provides little or no incentive to acquire credit or increase savings.

Turning to United States aid programs in less-developed countries, Schultz states that such programs should be founded on the knowledge, availability, acceptance, and use of new agricultural inputs with relatively high payoff as inducements to improve agricultural production. He reiterates the role and importance of investment in labor.

Within modern agriculture, particularly in the United States, Schultz emphasizes the need for providing farm people with the knowledge and means for adjusting themselves and their resources to changing economic conditions emanating from within and outside the agricultural sector. But he finds that the political influence of the Southern Tradition, conflicting views among farm people, confused ideas of their leaders, and vested interests in production-price programs are walls that block progress—but walls which he forecasts will come tumbling down.

The book is provocative and stimulating. However, its reasoning rests heavily on an implicit faith in price-income incentives which alone are not likely to bring the sought-after large increases in agricultural production in less-developed countries. The agricultural problems and their possible solutions at home and abroad are much more complex.

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Monographs in Experimental Botany Series

Introduction to Thermodynamics. D. C. Spanner. Academic Press, New York, 1964. xii + 278 pp. Illus. $7.50.

The book under review, *Introduction to Thermodynamics*, is the first of a series of monographs in experimental botany. As Spanner states in his preface it is intended as a textbook on thermodynamics for those who are interested in any biological field, even though there is some bias in the book toward botanical problems. Most students in the biological sciences acquire whatever understanding they have of thermodynamics during their study of chemistry. That contact with the subject usually leaves the impression that thermodynamics is a subtle, magical discipline that is invoked to explain phenomena which cannot be described in a more immediate physical context. It is to the alleviation of this unfortunate situation that the author has devoted this book.

I believe that he has in large measure accomplished the task that he set for himself. The book is sound scientifically and didactically and should provide a good basis for classroom teaching; it should also be useful to the mature research worker who wishes to study on his own.

In content the book is divided somewhat naturally into two main parts. The first part, comprising the first ten chapters, constitutes a rather abbreviated presentation of the basic principles of thermodynamics, a presentation much like that used in the standard undergraduate course in a physical science curriculum. Brevity is the principal characteristic that distinguishes this treatment from others in the textbook literature. The reader whose interest lies principally in the biological application of the subject and whose general background in thermodynamics is adequate might reasonably begin his study with chapter 11, a procedure made practical by the inclusion of a list of symbols and their denotations.

The second part of the book is concerned with the application of thermodynamic reasoning to biological problems. As one might expect, a major portion is devoted to the subjects of membrane equilibria, properties of electrolytes, and water relations. The strength of the author's treatment resides in his insistent use of the chemical potential in an explicit manner. The remainder of the book is concerned with photosynthesis, thermodynamic efficiency, and irreversible processes.

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New Books

Biological and Medical Sciences

Advances in Clinical Chemistry. vol. 7. Harry Sobotka and C. P. Stewart, Eds. Academic Press, New York, 1964. 536 pp. Illus. $16.50. Six papers: "Principles and applications of atomic absorption spectroscopy" by Alfred Zettner; "Aspects of disorders of the kynurenine pathway of tryptophan metabolism in man" by Luigi Musajo and Carlo A. Benassi; "The clinical biochemistry of the muscular dystrophies" by W. H. S. Thomson; "Mucopolysaccharides in disease" by J. S. Brimacombe and M. Stacey; "Proteins, mucosubstances, and biologically active components of gastric secretion" by George B. Jerzy Glass; and "Fractionation of macromolecular components of human gastric juice by electrophoresis, chromatography, and other physicochemical methods" by George B. Jerzy Glass.

Advances in Ecological Research. vol. 2. J. B. Cragg, Ed. Academic Press, New York, 1964. 276 pp. Illus. $9.50. Four papers: "Analysis of processes involved in the natural control of insects" by M. E. Solomon; "The use of statistics in phytosociology" by J. M. Lambert and M. B. Dale; "Litter production in forests of the world" by J. Roger Bray and Eville Gorham; and "Forty years of genecology" by J. Heslop-Harrison.

Advances in Genetics. vol. 12. E. W. Caspari and J. M. Thoday, Eds. Academic Press, New York, 1964. 398 pp. Illus. $14. Four papers: "The biological coding problem" by Frank Lanni; "Differentiation in monolayer tissue culture cells" by Eric H. Davidson; "The biological composition of a taxonomic species in *Gilia*" by Verne Grant; and Cytoplasmic inheritance in the genus *Streptocarpus*" by Friedrich Oehlkers.

Advances in Gerontological Research. vol. 1. Bernard L. Strehler, Ed. Academic Press, New York, 1964. 422 pp. Illus. $13.50. Ten papers: "Histophysiology of the aging nervous system" by William Bondareff; "Proteins in development and senescence" by Simion Oeriu; "Changes in the nucleus with advancing age of the organism" by Warren Andrew; "Similarities and contrasts between radiation and time pathology" by George W. Casarett; "Cross-linkage and aging" by F. Marott Sinex; "The nucleic acids in development and aging" by Zh. A. Medvedev; "Genetic factors associated with aging" by Arnold M. Clark; "Isolated lipofuscin granules—a survey of a new field" by Sören Björkerud; "Autoimmunity in aging" by Herman T. Blumenthal and Aline W. Berns; and "On the histochemistry and ultrastructure of age pigment" by Bernard L. Strehler.

Advances in Immunology. vol. 4. F. J. Dixon, Jr., and J. H. Humphrey, Eds. Academic Press, New York, 1964. 488 pp. Illus. $15. Seven papers: "Ontogeny and phylogeny of adaptive immunity" by Robert A. Good and Ben W. Papermaster; "Cellular reactions in infection" by Emanuel Suter and Hansruedy Ramseier; "Ultrastructure of immunologic processes" by Joseph D. Feldman; "Cell wall antigens

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