

centrate on the "hardware," this view of the systems approach is quite enlightening.

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LIGHT AND LIVING MATTER, VOL. 1: THE PHYSICAL PART, by Roderick K. Clayton. 1970. McGraw-Hill Book Co., New York. 148 p. \$4.50.

This is an introduction to the nature of light and its interaction with matter and a review of the role of light in biology. The book is meant to be collateral reading in biology, chemistry, and physics courses, and it can be used in these respects. Specifically, in biology courses the book would be effective collateral reading for majors, but I do not recommend it for nonmajors. The book assumes, here and there, a working knowledge of first-year college calculus; however, the descriptive material can be understood without this knowledge.

The second chapter, "The Physics of Radiation and Matter," would be the most helpful to a biology major taking his first college course in biology. The chapter includes a presentation of the quantum theory, molecular states and orbitals, and the transfer-of-excitation theory.

This book would also be valuable to a biology instructor who does not have a strong background in the physical sciences. Such an instructor probably could cope with the text and would gain a better understanding of some of the physical principles underlying biological phenomena.

I recommend that the book be used as collateral reading in a course for biology majors, and that biology instructors add the book to their library.

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Botany

CELLULAR DIFFERENTIATION IN PLANTS, AND OTHER ESSAYS, by C. W. Wardlaw. 1970. Manchester University Press, Manchester, England. 160 p. \$6.50.

Wardlaw, the botanist who has contributed so much to the field of plant morphogenesis, "bio-essays" the field. In the introductory essay he examines the words of the major exponents of morphogenesis historically and considers what to do with their views and inferences in the light of contemporary knowledge. He then zeroes in on Turing's unitary reaction system as a useful holistic pattern to follow in morphogenetic research.

In the second essay he develops various approaches in viewing cellular dif-

ferentiation (physiology, morphogenesis, molecular biology) and presents new and fresh insights concerning the attitudes of each. He warns against neo-classical, incomplete approaches to studies in biology.

In the third essay Wardlaw attempts to reconcile divergent, conflicting views that have been formulated from conclusions drawn. Certain criteria were defined and applied to investigations on apices of plants and reciprocal relationships with the developing shoot. Such reconciliations are to get at the truths about morphogenesis.

The fourth essay presents several of the enigmas in plant development: floral organogenesis, chemical morphogenesis, and phyletic gaps, for example. Wardlaw suggests some rights and some wrongs of the concepts of performance and epigenesis. If we are to maintain our self-respect as scholars we must eliminate some of these gaps in knowledge or outlook. We need to think more deeply and in new ways before declaring an enigma.

The last essay considers the theme of organization, viewing it through the controlling principle (entelechy) and the creation of wholes (holism). The poetic euphoria with which these concepts invest us is admirable but gives a scientist very few tangibles in which to sink his "practical teeth." The author feels that analysis of the holistic parts can yield testable hypotheses. Initiation of disorganization patterns (anomalies), whether by radiation or growth-substance treatments, has raised new questions, not solved old problems. Chemical morphogenesis has not created new species. But can there be plant neoformations equivalent to Huxley's "test tube babies"? Someday, perhaps.

Wardlaw's essays collectively form a semipoetic, beautifully done book that should capture the interest of the novice in the field of plant morphogenesis and still present the mature thinker with many unresolved problems, both practical and philosophic.

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PLANT CELL PHYSIOLOGY: A PHYSICO-CHEMICAL APPROACH, by Park S. Nobel. 1970. W. H. Freeman & Co., San Francisco. 275 p. \$7.75.

A long dearth of new general textbooks in plant physiology, coupled with much research activity in the field, has stimulated the publication of several introductory and advanced textbooks in recent years. Nobel's book treats topics that cannot be covered in detail in an elementary textbook, and yet its content is basic to anything more than a descriptive discussion of many processes in plant cells. In particular, it is concerned with the physicochemical explanations for the movements of ions

and water across cell membranes and for the photosynthetic conversion of radiant energy to chemical energy. The book presupposes a basic background in plant biology and some knowledge of elementary calculus, both of which should be in the armamentarium of the advanced undergraduate students and beginning graduate students to whom the book is directed.

The first half of the book concerns itself with water relations and ion transport. The author is consistent with most current textbooks in using the term "water potential" instead of the older ones, "diffusion pressure deficit" and "suction pressure." But although most physiologists agree as to the components of the water potential being osmotic pressure, hydrostatic pressure, and matric potential, it should be noted that they haven't yet agreed on the symbolic notation to be used for these quantities. To illustrate the detailed quantitative treatment of ion movement, as an example, the familiar Nernst equation is presented but the Goldman and Ussing-Teorell equations, usually found only in monographs of this subject, are also used. Irreversible thermodynamics are briefly introduced and applied to solute movement.

In the second half of the book the concepts and equations of photochemistry are developed and applied to green-plant photosynthesis. In the final chapter, Gibbs free energy and the equations concerning its interconversion are taken up, and a brief treatment of chloroplast and mitochondrial bioenergetics is included.

As Nobel states in his preface, the stress is on the underlying theoretic bases: relatively few experimental observations or applications of the concepts are made. The student can be stimulated to test his understanding of the concepts by working with the problems presented at the end of each chapter. Four useful appendices (and the answers to the problems) and an adequate index conclude the book. The subject matter does not lend itself to lavish illustration, but those present and the typography are of the high quality that one has come to expect from this publisher.

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Education

ACADEMIC GAMESMANSHIP, by Pierre van den Berghe. 1970. Abelard-Schuman, Ltd., London. 116 p. \$4.95. (hard-back).

Pierre van den Berghe, distinguished language scholar and sociologist specializing in ethnic relationships, continues to distinguish himself in volume on the sociology of the academic community. It is clearly autobiographic,

and it is pervasive of the college scene and realistic. For anyone who sees his own reflection in the book the truth is stark. For the novice in the academic world it is a how-to-do-it manual. *Academic Gamesmanship* is expressly written "to help young professors either to change these rules or, if this is impossible, to use them to win deserved advancement."

The flyleaf says "*Academic Gamesmanship* will be to the Ph.D. what *The Peter Principle* is to the business executive: a brilliant—and hilarious—guide to the strategies of success." Among these strategies van den Berghe includes publishing in highly specialized journals and publishing controversial papers, which are criticized so that rebuttal papers are in order. He advises the young Ph.D. to go to all the national meetings he can afford to attend or can bill his institution for. Other gambits: Have your secretary interrupt a department meeting to let you (and the whole staff) know that you have a person-to-person call from someone in Washington, D.C. Attend seminars and praise papers of the strong members of a department and find holes in papers of weak members. Take your first position at a low salary in a prestigious institution rather than at a higher salary in an unknown four-year college or a junior or community college. Play the game. Expend your energies in manipulation within the system; if you haven't risen in 10 years after receiving your Ph.D., chuck it all and go out and sell shoes.

The prospective Ph.D. views the college and university atmosphere as a pure society of teachers and scholars who operate at a high ethical and professional level, who are essentially immune from disreputable or corrupt practices, who recommend young scholars for advancement purely on merit, and who bestow appropriate rewards objectively. Not so! Van den Berghe reveals the real world of academics as one of power plays, buck-passing, credit-stealing, playing favorites, bribing secretaries, spreading vicious rumors, pandering—of anything and everything in the line of duty in the march to the top. He punctures academic pomposity and exposes the guts of the system. The author describes his book as an insider's book, and the reviewer must concede that the revelations are hard truths. And in recognizing those truths one also has to admit the truth of phrase "to know one is to be one" and will see himself as "master" or "victim" of the system.

Van den Berghe compares the academic community to the medieval guilds, in which apprentices went through a prolonged period of subserviency to and emulation of the master. The academic community sets up a series of hurdles and promulgates myths about the profession, in order to

retain a restricted group of professionals: something like the tactics of the AMA. Van den Berghe lists three of the myths:

"An academic career requires superior ability."

"The rewards, especially the material rewards, of academic life are meager."

"Academic life is dull."

Plagiarism, which is the thorn in the side of the academic world, is played off very lightly in this book. Students are even advised "to make blanket intellectual acknowledgements to their teachers in the preface of their theses," in order to make it easier for their professors to use the material as their own in other papers. At times it is difficult to distinguish van den Berghe's prescriptions from his descriptions; for example, over-zealous praise in a review of a colleague's book can be taken as good advice or as a case of the way things are. The same can be said of "avoidance of teaching beyond the unavoidable minimum" as the prime condition of success in an academic career.

In general, *Academic Gamesmanship* is a highly illuminating exposé of the life of faculty and administrators. For the most part, the rhetoric depicts the scene. This reviewer, however, takes exception to the statement, "The more obscure the quotation, the more prestigious it is to quote and quoted alike," and to the suggestion that when one reaches full professorship he should stop publishing, because a full professor's I.Q. will have "seriously deteriorated," and to the opinion that a senile professor "can still serve a useful and decorous function as chairman or dean."

Academic Gamesmanship is a must for everyone in the academic world—from the department secretary to the chairman of the board of regents.

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THE CHILD'S CONCEPTION OF MOVEMENT AND SPEED, by Jean Piaget. 1970. [Original French edition, 1946.] Basic Books, New York. 317 p. \$7.95.

In a lifetime of work, Jean Piaget and his collaborators have conducted extensive investigations into children's conception of many phenomena and, more important, have produced a theory of the intellectual development of children that encompasses their many findings. Although not directly concerned with education and schools, Piaget's psychology of development has tremendous implications for education, particularly in science. These implications are evident in this one of his many books.

Using a ball rolled down a plane as an example of accelerated movement, he studied (via individual interviews—his usual approach) 65 children whose

ages ranged from five to 14 years. He identified several stages in the development of the concept of acceleration. In the earliest stage no concept of uniform acceleration existed. In the second stage (apparently appearing most often at age six, judging from the cases cited) children show an intuitive conception of acceleration but cannot express it in terms of time and distance traveled. In the next stage, acceleration is still not seen as a relation between distance traveled and time, but the children recognize when the speeds of two simultaneous movements have to be compared, and they can be helped to a more advanced understanding. In the fourth stage (average age of its appearance, 11 years) the subjects "accept without hesitation that the time taken for each new equal distance decreases and that with each new equal time the distance traversed increases." Among the considerations for which there are important implications is grade placement: there is no point in attempting to teach a concept before children have reached the stage of development at which they are able to deal with it.

The reader who has no prior knowledge of Piagetian psychology probably should not begin with this book, since it assumes an understanding of the basic elements of his theory of development. Among many good places for the reader to start would be the chapter in M. R. Foree's *Psychology of Education* (1965: Ronald Press Co., New York) or the several chapters in Alfred L. Baldwin's *Theories of Child Development* (1965: Ronald Press Co., New York). From there the more serious reader can proceed to the book reviewed here or to others of Piaget's books having particular significance for science education, such as *The Child's Conception of Physical Causality* (1960: Littlefield, Adams & Co., New York), and (with Barbel Inhelder) *The Growth of Logical Thinking from Childhood to Adolescence* (1958: Basic Books, New York).

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ACADEMIC DEGREE STRUCTURES: INNOVATIVE APPROACHES, by Stephen H. Spurr. 1970. McGraw-Hill Book Co., New York. 224 p. \$5.95.

Spurr is dean of the Horace N. Rackham School of Graduate Studies, University of Michigan. His book, written at the request of the Carnegie Commission on Higher Education, is subtitled "Principles of Reform in Degree Structures in the United States." It should become a standard reference work. All faculty and student committees concerned with academic affairs should have access to it.

The book reads easily, thanks to