sense. Nevertheless, the terminology is confusing to the layman, and calling genetic fitness "Darwinian" does not entirely eliminate confusion. It is, moreover, historically inaccurate, because Darwin himself did not make the distinction.

Chapter 7 is a brief but adequate summary of what is known of the phylogeny and taxonomy of man, fossil and living. On evidence from the australopithecines, Dobzhansky now withdraws an earlier opinion that the Hominidae have always been monophyletic, but he continues to maintain (as does the consensus) that the later lineage has been unispecific and that *Homo sapiens* was monophyletic in origin. The next chapter, on human mental faculties and their antecedents, is in effect a combined biological and cultural definition of the species in terms ranging from brain size to esthetics. Prehuman antecedents for all those faculties are indeed found, but their level and combination in man are uniquely diagnostic. Two chapters are then devoted to the knotty and touchy subjects of polymorphism, class, caste, and race. With his customary calm good sense, the author summarizes the known facts and steers equally clear of the hysteria of the left ("There are no races!") and of the right ("There are absolutely superior and inferior races!").

The last two chapters give Dobzhansky another chance to counteract hysteria in evaluating contrasting views of present evolutionary trends in mankind. Biological evolution is continuing and will continue in our species. It will certainly be affected by increased radiation (including fallout), by the population explosion, by medical relaxation of selective mortality, and by other current trends. Some of the effects may clearly be detrimental and call for remedies. It is by no means clear, on present evidence, that the overall trend is detrimental or that proposed panaceas are either practical or needed.

Dobzhansky's careful balancing of evidence and his avoidance of premature conclusions prevent him from giving absolute answers to many of the questions he raises. Unlike some of his colleagues, whom he opposes firmly but without rancor, he makes no apocalyptic pronouncements and gives no *ex cathedra* solutions for all the world's ills. To those who find comfort in dogma and fiat, his book may seem bothersomely inconclusive. The firmest general conclusion is that not enough is known. What is actually known or reasonably surmised is here splendidly summarized and interpreted. No one who is concerned with his own nature and that of mankind—and this includes the poets, philosophers, and theologians—can afford to miss this book.

Theory and Application

Molecular Orbital Theory for Organic Chemists. Andrew Streitwieser, Jr. Wiley, New York, 1961. xvi + 489 pp. Illus. $14.50.

This book is divided into three nearly equal parts covering (i) molecular orbital theory, (ii) its application to the interpretation of the properties of molecules, and (iii) its applications to reactions and intermediates. The first part proceeds lucidly, perhaps brilliantly, through a discussion of the orbital approach to quantum mechanics, the Hückel molecular orbital theory, and the technique of applying the theory to π-electron systems. Even the chapter on matrices and group theory should be clear to students with limited mathematical training, and numerous problems are presented so that the reader can test his skill. Since the book is, among other things, a text, we were particularly interested in its handling of the approximations obviously necessary in the application of quantum theory to organic chemistry. We were slightly bemused to observe that half of the solutions were omitted for the only problem the author discusses "exactly" (that of one particle on a circle). As a result of this omission, the reader might be rather at a loss to understand the degeneracy of the second energy level in the perimeter model for benzene. More significant, however, is the disturbing omission of critical discussion of approximations. Surely, organic chemists are capable of a qualitative understanding of the errors involved in neglecting antisymmetry and electron spin, the limitations inherent in the orbital approach even with self-consistent field orbitals, the further approximation of pairwise occupied orthogonal orbitals, and the neglect of quantities such as electron repulsion and bond integrals. (These integrals are not necessarily zero, even for orthogonal orbitals, despite statements in the book to the contrary.) Some of these topics are skirted briefly, and some are adequately discussed in the final chapter of the book; but it would be most desirable to have the discussion of all of these topics where it would be read by those studying the apparatus presented in the initial chapters.

Parts 2 and 3 are almost overwhelming in their detail and completeness of coverage. They comprise a highly documented and impartially critical comparison of a manifold of theoretical predictions with experimental results. In several cases the calculations are the author's own; by this means if by no other he establishes himself as an expert in the field. Among the topics covered are bond order, dipole moments, electron spin resonance, ionization and reduction potentials, spectra, aromaticity, transition state theory, nonclassical ions, acidity, and certain reaction mechanisms.

In spite of the criticisms expressed here, *Molecular Orbital Theory for Organic Chemists* is an important work which nearly every organic chemist will want to study. Its lucidity and completeness make it good, both as a text and as a reference. Its main limitation is that the curtailment of the discussion of spin and related topics will, to some extent, prevent the book from serving as a guide to the future as successfully as it now serves as a monument to the progress made in applied molecular orbital theory during the last decade.

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Numerical Analysis

Discrete Variable Methods in Ordinary Differential Equations. Peter Henrici. Wiley, New York, 1962. xi + 407 pp. Illus. $11.50.

High-speed, automatic, stored-program digital computers were developed about 10 years ago, and as a result of their mushroom-like growth they can now be found in the research laboratories of industries, governments, and universities throughout the world. It seems unquestionable that they will become increasingly useful in the future; their impact on applied mathematics and nu-

merical analysis is already considerable and promises to intensify greatly.

The present book is a valuable contribution to the development and presentation of mathematical theory and methodology, designed to take advantage of the new and powerful computing machines. The main body of the text presents a systematic and thorough analysis of the most important finite difference approximations to ordinary differential equations. Discretization (or "truncation") error and round-off error are given equal attention. Both analytical and statistical methods are employed in the analysis of round-off error. Many computer experiments are included to illustrate and support the theory.

As a result of the systematic organization of the main results and the 170 problems to be solved, the volume will serve well as an advanced text. In fact, the problems contain many interesting special results and augment the main content of the book. The practising mathematicians will find over 200 references, mostly to literature written in the last decade. The references are made especially useful by bibliographical notes at the end of each chapter.

There is so much current activity in this field that the future will certainly see more publications and new results. In spite of this, the present work is and will remain a valuable addition to the library of any serious student of numerical analysis.

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Plant, Animal, Soil Sciences

Growth in Living Systems. M. X. Zarrow, Ed. Basic Books, New York, 1961. xv + 759 pp. Illus. $15.

Growth in Living Systems represents the published proceedings of an international symposium on growth held at Purdue University in June 1960. The symposium, organized in conjunction with the dedication of Purdue's new Life Science Building, was intended to be interdisciplinary in approach, paralleling the concept which led to the construction of the Life Science Building as a huge, single structure aimed at uniting physically such diverse departments in plant, animal, and soil sciences as, for example, biophysics, soil conservation, nutrition, crop production, and microbiology.

The first two days were devoted to general sessions planned for the entire audience of several thousand people. The list of speakers was impressive indeed and included F. H. C. Crick, M. B. Hoagland, Daniel Mazia, T. T. Puck, Aron Moscona, M. Sussman, J. Brachet, C. W. Wardlaw, Armin Brau, M. Singer, and James Bonner. An equally distinguished group was invited to present papers at the several concurrent sessions comprising the third day of the symposium.

It is not possible to review here the merits of individual papers. Some are speculative, some are technical, some are reviews; some are directed at experts in the field, others assume total ignorance on the part of the reader; some attempt to attain depth in coverage and insight, others are clearly intended to be classed as superficial generalizations; some are superbly presented essays, others would fail to pass most editorial review boards.

Two unfortunate aspects of the volume need to be emphasized. First, most of those papers presenting new data have been preceded in the published record by scientific reports that appeared between the time the symposium was held and the present. By the same token, many of the review papers are almost direct duplications of reviews published elsewhere by the same authors.

The second aspect is perhaps more serious. The volume attempts to do too many things for too many people at the same time. It is difficult to visualize the same person appreciating a detailed, careful analysis of recombination in bacteria, and yet being satisfied with a suggestion that a hormone may prevent the genetic "count-down" of cells programmed to die. Similarly, a reader who has the sophistication required for understanding the kinetics of enzyme induction can hardly be the same reader for whose benefit the editor feels compelled to include a glossary of terms in which mutagenesis is defined as "the process of mutation," zygote is classified as "the cell resulting from the union of the male and female gametes," and DNA is equated with deoxyribonucleic acid.

It is difficult to argue with the goal of interdisciplinary understanding; one can only question whether the symposium achieved its goal. For those who attended the meetings, the answer is probably a qualified yes. For those who have to rely on the published proceedings, I suspect the majority will have to answer no.

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Living Matter

The Biosynthesis of Proteins. H. Chantrenne. Pergamon, New York, 1961. ix + 220 pp. Illus. Plates. $6.50.

This volume represents a noteworthy integration of knowledge and theories in the highly important and rapidly developing field of protein biosynthesis. Chantrenne has published extensively in several of the areas concerned and has been able to bring together contributions represented by over a thousand publications in such fields as biochemistry, genetics, cytology, cellular physiology, immunology, and microbiology. He divided the subject into five chapters representing, respectively, genetic control, the sites of protein synthesis, the relative significance of ribonucleic and deoxyribonucleic acids (RNA and DNA), the chemical pathway and the chemistry of intermediates between amino acids and protein, and the mechanisms of regulation.

In the first chapter basic observations on hereditary abnormalities in man—for example, in alcaptonuria and congenital galactosemia—provide an introduction to the subject of genetic control of metabolic processes and to the formulation of the one-gene-one-enzyme hypothesis, which is elaborated with recent studies of microbial mutants and varieties of human hemoglobin. The second chapter reviews the ability of isolated cellular fractions like ribosomes, mitochondria, chloroplasts, and cell nuclei to synthesize proteins. The respective roles of DNA and RNA in protein synthesis are discussed in the third chapter, with emphasis on the heterogeneity of the latter and on the importance of its structural integrity for protein synthesis.

In the chapter on chemical pathways the energy requirement for protein biosynthesis is considered on thermodynamic grounds, and various experiments which describe the respective functions of adenosine triphosphate, amino acid