de Beauregard argues for a philosophy of being from relativity theory, while Miliĉ Ĉapek counters with an argument for a philosophy of becoming. The controversy centers around the problem of whether or not there is a process of becoming in the physical world which runs parallel to our experience. Ĉapek argues that there is an objective succession of moments in the objective world corresponding to the transient character of our mental present. Costa de Beauregard argues for covariance. Approaching the problem from still another perspective, Herbert Dingle explores the question of whether time in relativity theory is a measurement or a coordinate of the universe. His conclusion is "that the physical phenomena which have led to the theory of relativity have no contribution to make to the solution of problems concerned with time." The reason for his conclusion is based on the proposition that relativity theory is concerned only with "time at a distance" and all metaphysical and psychological problems of time *here* are irrelevant to the theory of relativity.

There are also essays in this part on time and quantum theory (E. J. Zimmerman), time and thermodynamics (Richard Schlegel), time and the probabilistic view of the world (Satosi Watanabe), and time and the universe (G. J. Whitrow), and a summary essay on the study of time by the editor.

One of the most important characteristics of these essays is that their authors have written them around challenging and suggestive interpretations. They have made no concessions to popularization, but neither have they indulged in obscurity or ambiguity. The editor could have made additional choices for inclusion, but the selections he did make are excellent, and he deserves the highest praise for bringing together in a single volume such a cluster of distinguished scholarship.

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European Prehistory

It has long been customary for archeologists to consider man's prehistoric past in terms of stages of technological development: our traditional reference scheme of the three consecutive ages of Stone, Bronze, and Iron dates to the publication (1836) of C. J. Thomsen's classification of the archeological collections in what is now the National Museum in Copenhagen. During the past three decades, some archeologists have made conscious efforts to extend the breadth and scope of such a limiting conceptual model of the past. The archeologist, by drawing on techniques primarily scientific in character, can now incorporate in his interpretation data concerning changes in particular aspects of the natural environment and in the economic activities of extinct, nonliterate societies. The resultant technological-economic interpretive schemes are, manifestly, essentially interdisciplinary—ideally, "scientific archeology" is a bridge between C. P. Snow's Two Cultures.

Professor Stuart Piggott's **Ancient Europe, A Survey** (Aldine, Chicago, 1966. 367 pp., $7.50) embraces the up-to-date "scientific" archeologist's interest in man's mastery over particular environments and various technical problems. But as Piggott demonstrates most admirably, the writing of prehistory involves far more than the description and classification of economic activities, artifacts, and cultures. Essentially, prehistory is a part of history. It is a matter of an individual prehistorian's interpretation of man's achievement in his past. In this the prehistorian, like the historian, will be influenced by the standards of his age. Piggott's private view is a particularly timely one: the omnipresent conflict between innovators and conservators, between developed and underdeveloped peoples.

This survey begins with the spread of the first agricultural communities from the Aegean to the Baltic and Atlantic seaboards in the period 6000 to 2500 B.C. As innovations transmitted by movements of peoples and by assimilation, the arts of animal domestication and cereal cultivation, and the custom of living in permanent or semi-permanent villages, contrast strongly with the primary Paleolithic-Mesolithic traditions of the indigenous hunter-fishers. The consequent development of this basic stratum of stone-using farmers is disrupted by pastoralist immigrants from the Russian steppeland, who may have been associated with the dispersal of the Indo-European languages, and who seem to have provided a dominant element in the society that was to follow.

With the development of copper and soon bronze technology, Piggott traces the establishment of patterns of trade relations and the first stammering beginnings of an armaments race. Increase in trade, carrying with it a growing awareness, in a now predominantly Celtic Central Europe, of the rich civilizations of the Aegean and Orient, and increasing technological development and improvements in the art of war lead to a buildup of the European economic position, and, ultimately, to the collapse of the Mycenaean world. Subsequent shifts in the balance of power and movements of peoples all over mainland Europe, together with the acquisition of techniques of working iron, form the background to the final confrontation: that of the Roman and the Barbarian documented in classical sources.

Piggott's enquiry into the ancient origins of historical Europe is original, closely argued, and fascinating. Although Piggott disarmingly claims that his book is one man's view of European prehistory, this landmark in archeological writing will gain many converts among layman and specialist alike.

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Biochemistry

The new, completely revised and reset third edition of Lester Smith's monograph **Vitamin B_{12}** (Methuen, London; Wiley, New York, ed. 3, 1965. 192 pp., $4.25) demonstrates the considerable progress in the chemistry and biochemistry of vitamin B_{12} made during a 5-year period as a result of the discovery of the vitamin B_{12}-coenzymes in 1958. In a style that is admirably compact but nevertheless readable the author describes the frontiers of research and considers the literature up to 1963. Several chapters cover, sometimes in detail, the origin, distribution, isolation, chemistry, and nomenclature of vitamin B_{12} and vitamin B_{12}-coenzyme, as well as their derivatives and analogues including the vitamin B_{12} antagonists. Probably because of limited space the biological and medical aspects of vitamin B_{12} and intrinsic factor are only described as a selected treatise. The short chapters on the assay and mechanism of action of vitamin B_{12}, vitamin B_{12}-coenzyme and intrinsic factor, vitamin B_{12}-binding factors, the metabolism of vitamin B_{12} in mammalians and man, and the diagnosis and therapy of vitamin B_{12} deficiency and nutritional aspects do not

always represent up-to-date information, but these chapters trace very well the most important facts and are reliable guides into the original literature. A more detailed subject index and an index of authors would be helpful and would improve the book's value as a reference source. Since a sufficiently detailed, modern, and critical review of the biochemical, nutritional, and medical aspects of vitamin B_{12} and vitamin B_{12}-coenzyme is not now available, this part of the book should be supplemented in the next edition.

The small book is at the present moment the best well-balanced introduction to the continuously expanding field of research on vitamin B_{12} and its application. The book also documents how much the author and his associates have contributed since 1948 when vitamin B_{12} was isolated simultaneously in his laboratory and by Karl Folker's group in Rahway.

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Analytical Dynamics

The word treatise in a book title, as in L. A. Pars' **A Treatise on Analytical Dynamics** (Wiley, New York, 1965. 662 pp., $27.50), implies both a broad scope and a relatively high level of treatment. Although no book on dynamics can exhaust the subject, this one covers thoroughly a wide range of fundamental topics, and the treatment is indeed an advanced one. These topics include those that one expects to find in any general treatment of dynamics, that is, Newton's and Lagrange's equations, constraints, Hamilton's principle, rigid body rotations, small oscillations, Hamilton-Jacobi theory, Hamilton's equations, contact transformations, and the principle of least action. Some less-familiar topics are the Gibbs-Appell equations, impulsive motion, the three-body problem, and periodic orbits. A short chapter introduces the dynamics of the special theory of relativity, but merely as a class of problems concerning particles with a peculiar mass variation (the corresponding classical problems, such as rockets, are not treated). Several chapters on stability theory and nonlinear problems, and a discussion of the ergodic theorem, are welcome additions to the above.

As a theoretical physicist, I therefore view the book from a particular frame of reference. Thus I would like some discussion of the foundations of Newtonian and relativistic mechanics (which have been purposely omitted to save space), and some material indicating the power and usefulness of group theory in dynamics (a usefulness greater than that indicated in the author's introduction), and a treatment of its connection with invariance principles and conservation laws. Further, I would prefer a greater use of physical insight in setting up and attacking problems. But the book was not written by, nor primarily intended for, a physicist. The author is an accomplished mathematician, and uses the common language of mathematics in developing the subject for mathematicians, physicists, astronomers, and engineers. His concern for rigor is therefore greater than that exercised by many others writing on the same subject. Although this gives the reader a clear idea of the limits of theory, it also results occasionally in the omission of problems which may be of interest.

The author treats many famous problems as worked examples, often treating them in great detail and from several points of view (this method is perhaps overdone). There are no problems or exercises for the reader.

Comparing this book with a standard work in the field, Whittaker's book of similar title, one notes that the volume by Pars contains about twice as much written material, and that many of the topics mentioned at the end of the first paragraph above are not covered in Whittaker. Figures, eschewed by Lagrange and Whittaker, are used here, adding clarity to the presentation (even more figures might have been helpful, and the addition of titles would further increase their usefulness). Matrix and vector notation and methods increase the clarity and simplicity of the presentation; still greater usage of these tools would have been preferable.

There are some errors, mostly typographical, but considering the size and complexity of the book, they are not excessive, and most can easily be remedied in a later printing. Some terms (such as "kineton") will be unfamiliar to the American reader. Unfortunately, they are not defined in the text, nor found in the index (which could profitably be expanded).

But the deficiencies noted above either arise from the reviewer's viewpoint, or are minor. This is clearly a broad, careful, and sophisticated survey of most of the major areas of classical dynamics, apparently intended as the modern standard for the *mathematical* development of dynamics. These intentions are well met.

The book is large (11.25 by 8 by 2 inches) and heavy (6 lb) but beautifully done. It has obviously been produced with much care by both author and publisher, and it is a pleasure to read. It is not suitable for use as a textbook, owing to its size, cost, and lack of problems, but it should be invaluable as a reference book, and should be in every institutional scientific library. I hope that a smaller and less-expensive edition will be produced so that everyone interested in this field can have his own copy.

Considering the present state of scientific publishing, it is gratifying to find a new book that actually fulfills a need, is painstakingly prepared, and which should have permanent value.

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Developmental Biology Series

Fertilization (Prentice-Hall, Englewood Cliffs, N.J., 1965. 145 pp., $2.95), by C. R. Austin, is the first volume in the Prentice-Hall series, Foundations of Developmental Biology. The series is designed to provide introductory material and to review recent progress in selected fields for students at intermediate and advanced levels.

This volume presents a comprehensive treatment of fertilization, with emphasis on the "cytological, physiological, and behavioral mechanisms concerned with the union of the gametes." The range of organisms includes bacteria and fungi as well as higher plants, sea urchins, and mammals. This comparative approach is used to define those features and principles in fertilization that are common to all organisms. The book is, in part, a product of the summer training program on the physiology of gametes and fertilization, held at the Marine Biological Laboratory (Woods Hole, Mass.), where the author is a member of the staff.

Chapter 1 gives a brief introduction into general cytology. Chapter 2 discusses the genetic and biological significance of fertilization in the propa-